THE ENGINEERING CONSTRUCTION WEEKLY

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Engineering NEWS-RECORD

January 6, 1938

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· ENGINEERING NEWS-RECORD ·

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VOL. 120 *JANUARY 6, 1938* NO. 1

THIS WEEK AND NEXT

ARTHUR E. MORGAN has proposed a federal law permitting the formation of interstate water control districts. An address in which he outlines the proposal is abstracted on page 13.

Although a small job, Pine View Dam in Utah takes its place among the grief-producers, according to Bureau of Reclamation engineers, who devised ways of grouting to eliminate the effects of a porous foundation.

Steel arch and truss approaches to the Golden Gate Bridge were erected by the use of timber falsework bents embodying ease of removal and reassembly.

Wisconsin, a pioneer in the silicosis compensation field, has its problems in administering this type of disability aired in the U. S. Bureau of Labor Statistics monthly bulletin.

A simple method of determining underground pressures due to foundation loads is outlined by N. M. Newmark on page 23.

High hardness of an underground water supply led Timken plant engineers to develop a radial well of unusual capacity.

When the new 40-passenger airplanes are put in service Salt Lake City will have a landing field and other facilities to care for them. How the field was financed and built through cooperative effort is told on another page.

NEXT WEEK, the Road Show Number. Outstanding among its many exclusive features is a series of reports on 1938 highway activity in 38 states. Also included are statistics on past and future road building as well as trends in types of roads. Among the subjects discussed in this section are: grading, surfacing, materials, research, planning and design. This big issue should be an invaluable handbook for the highway builder.

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THE COVER shows Pine View Dam in Utah. Grouting operations on this dam are described on page 15.

Number of copies of this issue printed: 33,057

No More *Marker Maintenance* *Expense!*

Atlas White pedestrian markers in Vermilion Street, Danville, Ill. City Engineer, L. H. Kirby; Contractor, R. McCalman, Inc., Danville.

Atlas White traffic markers are permanent—require no upkeep—actually pay for themselves by saving maintenance expense

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Consider the tremendous saving you'll accomplish by installing markers of Atlas White portland cement. These markers are *permanent*. This means that their first cost is the last cost. They'll never require maintenance. They actually pay for themselves over a period of years. And from then on they continue to save, each year, the maintenance expense which temporary markers require! Moreover, Atlas White markers are always white—always easy to see.

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FOR TRAFFIC MARKERS

THE WEEK'S EVENTS

PWA Power Projects Get Court Approval

Supreme Court holds that cities may build power plants with funds from federal government

Towns and cities may build power plants and distribution systems in competition with the privately owned electric utilities that now serve them, according to the U. S. Supreme Court. The court made this finding on Jan. 3 in two cases brought to it from the lower courts, one by the Alabama Power Co. challenging the right of the PWA to make loans and grants to five towns for the construction of distribution systems and one by the Duke Power Co. in an effort to prevent the construction of a power plant by Greenwood County, S. C., with PWA funds.

The effect of the court's decision goes far beyond these two test cases as 61 PWA power projects in 23 states have been held up by injunctions pending decisions in the test cases. These projects will cost $146,900,000.

The court said that each of the municipalities is authorized by law to operate electric power plants and distribution systems, each held an election before the loan agreement was entered into, and each went into the loan agreement without coercion. Also, the court noted that the municipalities were left free of federal control of their plants and business. Under these circumstances, the court said, the case comes down to the contention that consummation of the loan and grant should be enjoined on the ground that the Administrator lacked constitutional power to make the loans and grants; and that the money, which the communities have clear authority to take will be used in lawful, albeit destructive competition with the power companies.

On this point the court held that as the power companies had no exclusive franchise they had no cause for action, and even though their business is destroyed, they have suffered no legal wrong. As no wrong has been suffered by the companies and none can be under the conditions outlined, the court did not rule on the question of the constitutionality of the loans.

States Asked Not to Use Road Aid Allotments

Secretary Wallace on Dec. 31 allocated $195,000,000 to the various states and territories as federal aid for highway construction and grade crossing elimination work during the fiscal year ending June 30, 1939.

The Secretary pointed out that this action is mandatory under the law, but called attention to the request of the President that the authorizations be cancelled and requested the states to refrain from submitting definite projects for approval until Congress has had time to consider this recommendation. This request was made at the suggestion of the President.

Attorneys for the Department of Agriculture hold that the allotments can legally be cancelled by Congress at any time prior to the actual approval of definite projects by the Secretary.

A list of allotments to the states is given on page 5.

Labor and Material Bond Protects Railroad

The Supreme Court of the United States held Jan. 3 that a bonding company which has provided bond to a contractor guaranteeing payment for labor and materials is obligated under the bond to pay railroad freight charges due.

The case was brought by the Standard Accident Insurance Co., which was surety on a Post Office construction bond and had appealed from lower court decisions holding that the surety must pay the railroad freight charges. Overruling contentions of the surety company that it would be doing violence to language to describe freight transportation as "labor and materials," the court held that the law requiring labor and material bonds on Post Office contracts "should be liberally construed in aid of the evident public object—security to those who contribute labor or materials for public works."

Existing Hydro Plants To Be Investigated

Power Commission will determine whether existing unlicensed dams should be licensed

The Federal Power Commission has extended the investigation which it began early last month to determine whether existing dams on the Yadkin River ought to be subject to federal control (*ENR*, Dec. 23, 1937, p. 1002) and is now conducting a broad investigation of existing unlicensed hydroelectric power projects throughout the country on streams subject to federal jurisdiction.

The commission announced that it has discovered as a result of a preliminary investigation carried on since the passage of the Federal Power Act in 1935 that "there are now being maintained and operated at various sections in the United States a number of hydroelectric power developments not under license from the Federal Power Commission, located on streams over which Congress has jurisdiction under its authority to regulate commerce." The Commission believes that operation of these projects without a license may constitute a violation of the federal power act and asserts, moreover, that occupancy of the streams affects conservation and utilization of navigation and water power resources of the regions in which the projects are located.

The present investigation, therefore, will seek to determine whether operation of existing projects without a license violates any provision of the federal power act or any regulation drawn up under the act and whether the existing projects should not be required to obtain federal licenses.

• • •

Engineers Plan Meeting at San Francisco Fair

The four founder societies are planning to hold concurrent conventions in San Francisco during 1939 in connection with the Golden Gate Exposition to be held in that year. Negotiations are under way toward setting a date for the concurrent conventions and tentative agreement has been reached upon the week of July 10, 1939.

Building Supplies Trade Restrained

Federal Trade Commission issues cease and desist order against dealers' association

The National Federation of Builders Supplies Associations, its affiliated associations, and their dealer members, have been ordered by the Federal Trade Commission to cease and desist from a number of practices designed to prevent purchase of building materials direct from manufacturers or from dealers not members of the association, and tending also to fix prices of building supply materials. The federation, which consists of about 41 associations of dealers located in 32 states, was found by F.T.C. to constitute a national combination.

Chief among the practices from which the federation is ordered to desist are those designed to promote its policy of exclusive dealer distribution through dealers who are members of affiliated associations. These practices include circulation among manufacturers and producers of building supplies of lists containing names of recognized dealers, and the use of boycotts or threats of boycotts to compel manufacturers to refrain from selling freely to so-called irregular dealers, as well as making reports concerning equipment and business methods of competitors of dealer members for the purpose of inducing manufacturers not to sell to such competitors.

The federation and its members are also ordered to stop engaging in concerted action for the purpose of preventing manufacturers and producers from selling freely to consumers, contractors, the United States government, and other public bodies, and of preventing such classes of customers from purchasing freely from manufacturers and producers.

The Federal Trade Commission further orders the respondents to refrain from fixing or establishing uniform prices at which dealer members or others should sell materials and supplies in particular communities.

History of association

The Federal Trade Commission found that the National Federation of Builders Supply Associations was organized in 1933 as an expansion of a body known as the Building Material Dealers Alliance, which had carried on in the Cleveland-Pittsburgh area activities similar to those from which the federation is now ordered to desist.

A number of examples of trade restrictions achieved by the federation were found by the Trade Commission in its investigation. Outstanding among these was the formulation by the cement industry in April, 1935, of a policy of confining all sales to "equipped cement dealers." This policy was instituted as a result of negotiations with representatives of the federation.

The Federal Trade Commission also attributes to the federation's activities the inability of the Procurement Division of the Federal Relief Administration to obtain bids direct from manufacturers on cement to be used on relief projects in Ohio in 1935. Credit for both of these achievements was claimed by the federation in letters and bulletins circulated to its members.

Affiliated associations

As to the carrying on by local associations affiliated to the federation of practices prohibited by the commission's order, the commission found that "there was direct evidence in the record relative to the activity of the following respondent affiliated units: Building Materials Institute, Western Pennsylvania Builders Supply Alliance, Lime and Cement Exchange of Baltimore City, Maryland Builders Supply Association, New Jersey Mason Material Dealers Association, New York Builders Supply Association, The Building and Material Merchants of Chicago District, The Michigan Builders Supply Association, and the Ohio Builders Supply Association.

• • •

Sheridan Named a Member Of N. Y. Planning Body

Arthur V. Sheridan, president of the National Society of Professional Engineers, who has been chief engineer of the Borough of the Bronx in New York City, will represent the engineering profession on the New York City Planning Commission, a powerful body established under the new city charter which went into effect the first of the year. Another engineering voice will be provided on the commission by the ex-officio membership of Vernon S. Moon, chief engineer of the Board of Estimate. There is also an architect, Edwin A. Salmon, on the six-member board.

The new agency will have the controlling voice in all physical improvements of the city. The planning commission is in charge of the master plan for the city, and will recommend construction of schools, police stations, subways, housing developments and other city facilities. The commission expects to begin hearings on pending city projects very soon.

A. A. Berle, Jr., formerly city chamberlain, is chairman of the City Planning Commission, but his appointment is expected to be temporary.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED BY *ENGINEERING NEWS-RECORD*, IN DECEMBER, 1937

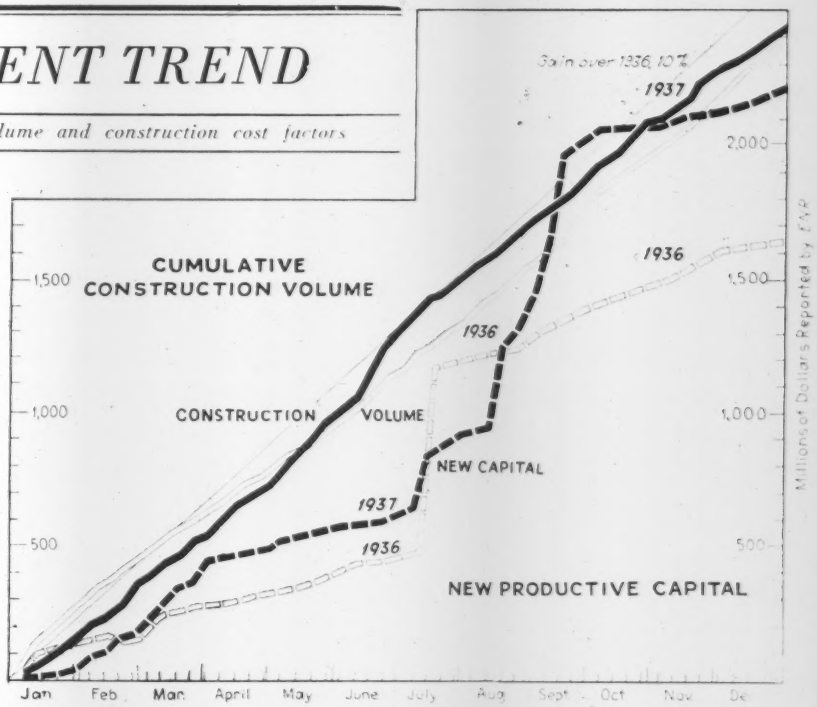
Engineering News-Record *reports projects of the following minimum cost: Water-works, excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000.

Five Weeks — Thousands of Dollars (000 Omitted)

Public Works	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States December 1937	United States Twelve Months 1937	United States Twelve Months 1936	Canada
Waterworks	407	1,101	1,145	1,441	1,358	2,302	**7,754**	104,449	92,478	394
Sewerage	205	2,188	646	1,283	1,545	589	**6,456**	95,294	121,056	429
Bridges, public	138	4,439	1,571	645	1,767	1,100	**9,660**	125,230	173,749	229
Earthwork and waterways	19	5,106	1,272	1,529	6,006	2,326	**16,258**	110,353	181,685	809
Streets and roads	813	6,252	8,200	4,649	8,686	5,285	**33,885**	414,537	483,475	749
Buildings, public	3,104	14,463	4,544	10,801	9,144	3,623	**45,679**	333,398	435,926	3,998
Unclassified, public	170	5,189	1,417	804	2,618	1,454	**11,652**	138,496	132,469	823
Total public	**4,856**	**38,738**	**18,795**	**21,152**	**31,124**	**16,679**	**131,344**	**1,321,757**	**1,620,838**	**7,403**
Federal government (included in above classifications)	747	9,126	2,477	2,299	6,494	2,877	**24,020**	205,588	319,538	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	7,859	14,067	.....
Buildings, industrial	1,188	4,218	981	2,605	2,225	3,046	**14,263**	477,298	309,477	1,929
Buildings, commercial	2,525	23,218	515	3,247	3,270	1,691	**34,466**	459,969	274,784	574
Unclassified, private	80	853	2,584	9,726	3,004	2,713	**18,960**	170,740	167,679	282
Total private	**3,793**	**28,289**	**4,080**	**15,578**	**8,499**	**7,450**	**67,689**	**1,115,866**	**766,007**	**2,785**
Total Engineering Construction										
December, 1937 (5 weeks)	**8,649**	**67,027**	**22,875**	**36,730**	**39,623**	**24,129**	**199,033**	.....	.....	**10,188**
November, 1937 (4 weeks)	5,421	87,590	12,440	26,357	19,721	14,052	**165,581**	.....	.....	9,779
December, 1936 (5 weeks)	16,908	70,684	35,222	63,829	53,150	26,508	**266,301**	.....	.....	3,821
Twelve months, 1937	111,994	1,058,304	242,379	422,723	358,418	243,745	.....	2,437,623	.....	135,508
Twelve months, 1936	148,295	775,769	208,735	423,135	444,978	285,933	.....	.....	2,386,845	93,794

THE CURRENT TREND

This week's news of contract volume and construction cost factors



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Jan. 7 1937	Dec. 30 1937	Jan. 6 1938
Federal	$3,704	$3,359	$2,465
State & Municipal	15,499	21,936	28,400
Total public	$19,203	$25,295	$30,865
Total private	21,244	19,694	18,312
TOTALS	$40,447	$44,989	$49,178

Cumulative	
1938 (1 week)	$49,178
1937 (1 week)	$40,447

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works $25,000; industrial buildings, $40,000; other buildings, $150,000.

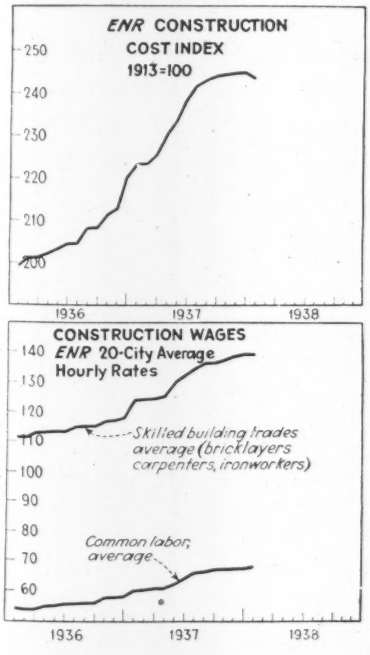
NEW PRODUCTIVE CAPITAL

	Cumulative 1937 1 Wk.	1938 1 Wk.
NON FEDERAL	$7,189	$6,481
State & mun. bonds	6,074	4,681
Corporate securities	240	1,800
PWA loans, grants	875	
RFC loans		
FEDERAL		
TOTAL CAPITAL	$7,189	$6,481

ENR INDEX NUMBERS

COST Base=100	1913	1926
Jan., 1938	243.85	117.22
Dec., 1937	244.95	117.75
Jan., 1937	223.45	107.41
1937 (Av.)	236.41	113.63
1936 (Av.)	206.41	99.22
1935 (Av.)	195.22	93.84

VOLUME	1913	1926
Dec., 1937	141	62
Nov., 1937	146	64
Dec., 1936	206	90
1937 (Av.)	171	74
1936 (Av.)	185	81
1935 (Av.)	135	59



THE MONTH'S SCOREBOARD

CONSTRUCTION VOLUME

(,000 omitted)	December 1936	1937	% Change	Twelve months 1936†	1937	% Change
Total	$266,301	$199,033	—25	$2,386,845	$2,437,623	+4
Private	140,999	67,689	—52	766,007	1,115,866	+48
Public	125,302	131,344	+5	1,620,838	1,321,757	—17
Federal	23,845	24,020	+.6	319,538	205,588	—35

NEW PRODUCTIVE CAPITAL

(,000 omitted)						
Total	$55,742	$91,811	+65	$1,639,617	$2,202,173	+37
Private Investment	43,755	91,811	+110	757,522	1,047,885	+41
Federal (non-fed. wk.)	11,987			190,858	408,065	+118
Federal (fed. wk.)				691,237	746,223	+10

†Fifty-three weeks.

CONSTRUCTION COSTS . . . WAGE RATES . . . PRICES

	January 1937	1938	% Change	Dec. 1936	Jan. 1937	Change Dec. to Jan. %	Dec. 1937	Jan. 1938	%
ENR Construction Cost Index, 1913 = 100	223.45	243.85	+9	220.05	223.45	+1.5	244.95	243.85	—.5

ENR 20-CITIES' AVERAGE

Common Labor	$.603	$.680	+13	$.586	$.603	+3	$.678	$.680	+.3
Skilled Labor	1.240	1.391	+12	1.180	1.240	+5	1.391	1.391	0
Bricklayers	1.313	1.480	+13	1.228	1.313	+7	1.480	1.480	0
Struct. Ironworkers	1.295	1.442	+11	1.234	1.295	+5	1.435	1.442	+.5
Carpenters	1.111	1.251	+13	1.079	1.111	+3	1.257	1.251	—.5
Cement, per bbl	$2.55	$2.53	—.8	$2.59	$2.55	—1.6	$2.53	$2.53	0
Reinforcing Steel, new billet	2.69	2.91	+8	2.67	2.69	+.8	2.91	2.91	0
Struct. Steel, Pittsburgh	2.05	2.25	+10	1.90	2.05	+8	2.25	2.25	0
Sand, per ton	1.15	1.24	+8	1.18	1.15	—2.6	1.23	1.24	+.8
Lumber, 2x4 Fir, per M	35.47	34.74	—2	33.23	35.47	+7	36.02	34.74	—4
Lumber, 2x4 Pine, per M	32.06	29.24	—9	30.49	32.06	+5	31.35	29.24	—7
Brick, Common, per M	13.58	14.16	+4	13.93	13.58	—2.6	14.11	14.16	+.4
Ready-mixed Concrete	7.14	7.39	+3	7.16	7.14	—.3	7.42	7.39	—.4
Struct. Clay Tile, 3x12x12	72.47	72.71	+.3	72.65	72.47	—.2	72.89	72.71	—.2
Paving Asphalt, cars, ton	17.05	16.98	—.4	16.93	17.05	+.7	16.99	16.98	—.1

MATERIAL SHIPMENTS . . . BUILDING PERMITS

	December 1936	1937	% Change	Nov. 1937	% Change Nov.-Dec.
Lumber (% 1929 wk. av.) N.L.M.A.	55	42	—24	54	—23
Steel A. I. S. I. (% operating capacity)	77.1	25.4	—67	39.3	—35

	November 1936	1937	% Change	Eleven months 1936	1937	% Change
Fabricated Struct. Steel* (A.I.S.C.)	134,115	128,556	—4	1,426,430	1,543,959	+7.6
Cement (USB of M) Thous. bbl	8,942	8,189	—8.4	106,320	109,218	+3
Building Permits, Dun & Bradstreet (,000 omitted)	$75,507	$69,568	—7.9	$896,940	$1,011,861	+12.8

*Subject to revision.

RENT INDEX

	November 1936	1937	% Change	Oct. 1937	% Change Oct.-Nov.
Rent (housing) Index, N.I.C.B.	81.4	89.1	+9	89.2	—.1

TVA Investigation Asked by Norris

Resolution provides for FTC probe of internal dissension in TVA board

Apparently convinced that an investigation into the tangled internal management of the Tennessee Valley Authority is inevitable, Sen. George W. Norris of Nebraska on Jan. 3 introduced a joint resolution appropriating $200,000 for such an inquiry, but directing that it be made, not by a Congressional committee, but by the Federal Trade Commission. Subjects to be covered would include:

1. Whether the TVA board is carrying out efficiently and economically the work authorized under the act.

2. Whether the work is handicapped by internal dissention among board members.

3. Whether any board members are serving in violation of the provisions of the provision of the TVA act which specifies that members of the board must believe "in the feasibility and wisdom of this act," or whether they have given any aid to power companies opposed to TVA.

4. What has been the loss to municipalities and farmers prevented from obtaining TVA power by injunction suits.

5. The number of suits pending against TVA brought by private utilities, and their effects.

6. To what extent the public interest has been affected by the efforts of the utilities to prevent farmers and municipalities from obtaining TVA power.

Senator Norris indicated that he regards the dissension within the TVA board of directors as much more important than the injunction suits.

The Norris resolution was immediately subjected to attack by Rep. May of Kentucky, ranking democratic member of the House committee on military affairs, which considers all TVA legislation. Charging Senator Norris with an attempt to drag "a red herring across the trail of a smouldering scandal," Mr. May declared his intention, in the near future, of introducing a resolution to provide a Congressional investigation into a number of matters:

1. That TVA directors misrepresented the size of the proposed Gilbertsville dam on Dec. 13, before the House Appropriation Committee.

2. That TVA "arrogantly ignores" the will of Congress by failing to submit an allocation of costs to its various activities, as directed by the act.

3. The truth of "generally whispered" charges of financial favoritism to political favorites, particularly in respect to Sen. Barry's marble claims.

4. Unlawful violation of that part of the act requiring an annual audit of accounts by the Comptroller-General.

5. What the present power policy of the TVA actually is, and how long it has been in effect.

6. The luring of industries to the Tennessee Valley from established locations; propaganda in the press, radio, schools, and churches; the accuracy of "yardstick" rates; and rate favoritism to large corporations.

Brooke Appointed President Of Chesapeake & Ohio

George D. Brooke, for the past year executive vice-president of the Chesapeake & Ohio Ry. has been appointed to the presidency of that line, succeeding the late W. J. Harahan. Mr. Brooke, who is 59 years old, has been an officer of the C. & O. since 1924.

After his graduation from the Virginia Military Institute in 1900, Mr. Brooke spent two years teaching at Culver Military Academy. He then entered railroad work as a rodman for the Baltimore & Ohio R. R., holding the positions of levelman, transitman, and assistant engineer over the next few years. In 1908 he was appointed assistant division engineer and later in the same year division engineer. Three years later he became assistant engineer in the operating department and shortly afterward assistant division superintendent, then superintendent.

After the war Mr. Brooke returned to the B. & O. as superintendent of transportation on western lines, but left that line in 1924 to become assistant to the vice president in charge of operations of the Chesapeake & Ohio. He became general manager of the latter line in 1926, vice-president in 1930 and executive vice-president a year ago last December.

Wilson Hydro Plant Evaluated

Annual TVA report reveals that value has been established at $31,000,000

Completion, and approval by the President, of the valuation of the Wilson dam and power house, which was taken over by TVA from the War Department in 1933, is announced in the annual report of the Tennessee Valley Authority which was submitted to Congress Dec. 31. The report covers the fiscal year ending June 30, 1937.

The Wilson dam and power house is estimated to have a net value to TVA of $31,300,000. Nearby steam plants erected originally in conjunction with the nitrate plants are held to have no present value to the TVA.

Navigation

The report points out that traffic on the Tennessee River, which fell to about 800,000 tons in 1932, has been steadily increasing. In 1936 traffic reached the pre-depression level of 2,166,000 tons. Figures for 1937 are expected to be the highest in the history of the river.

Power Generation

Gross operating revenue from power generation for the fiscal year was $1,654,000. Net operating expenses were $715,000. Although litigation and injunctions have increased the cost of doing business, it is believed that there will be few legal tangles in the future. Beginning of power generation at Norris and Wheeler dams nearly doubled the installed capacity of the entire system during the year. Six hundred and twenty-five miles of high voltage lines were built and twelve new distributing agencies and one large industrial plant were added to the list of customers. At the close of the fiscal year there were 32 local distributors and 9 industrial corporations in the TVA hookup.

Financial Report

TVA now has a total investment of $170,417,000. Of this amount $148,179,000 is tentatively charged to flood control and navigation. The electricity program is charged with $10,945,000. This, however, does not include any part of the cost of the dam structures; it is simply the cost of purely electrical facilities. To the national defense, $2,297,000 is charged; $7,995,000 to fertilizer and agricultural development, $886,000 to regional studies, experiments and demonstration, and $214,000 to emergency flood relief.

Albert Reichmann Retires From American Bridge

After having been in continuous service of the American Bridge Co. since its formation 36 years ago, Albert Reichmann, formerly assistant chief engineer and since 1935 vice-president, retired on Dec. 31. He will be 70 on Jan. 16. Long one of the best known figures in American bridge engineering, Mr. Reichmann is expected to maintain his interest in professional affairs.

A native of Dubuque, Iowa, Albert Reichmann began his engineering career as draftsman with the Lassig Bridge & Iron Works in October 1890, and a year later went to the old American Bridge Works of Chicago as draftsman and computer. He entered railroad service in 1894, becoming assistant engineer in charge of design in the bridge and building department of the Chicago, Milwaukee & St. Paul R. R. After seven years in this connection, he joined the American Bridge Co. at the time of its foundation, as division engineer. Thirty years later he was appointed assistant chief engineer, and in 1935 he was elected vice-president.

Mr. Reichmann long was treasurer of the Western Society of Engineers and in 1913 was its president. He also was director of the American Society of Civil Engineers (1929-1931).

ALBERT REICHMANN

During his long activity in bridge engineering he had a leading part in much noteworthy bridge and building construction, including the Thebes bridge over the Mississippi, San Francisco-Oakland Bay bridge, Michigan Avenue and Outer Drive bascules over the Chicago River, Union Station, Stevens Hotel, Palmer House, Post Office, and Chicago *Tribune* and *Daily News* buildings.

FEREAL AID ALLOTMENTS TO STATES

State	Sums Apportioned For: Regular Federal Aid	Secondary Feeder Roads	Elimination of Grade Crossings	Total Allotments
Alabama	$2,600,165	$520,033	$986,449	$4,106,647
Arizona	1,785,984	357,197	315,619	2,458,800
Arkansas	2,132,790	426,558	865,366	3,424,714
California	4,735,268	947,054	1,825,553	7,507,875
Colorado	2,271,785	454,357	632,565	3,358,707
Connecticut	785,963	157,193	417,706	1,360,862
Delaware	609,375	121,875	243,750	975,000
Florida	1,669,497	333,899	692,981	2,696,377
Georgia	3,154,850	630,970	1,194,288	4,980,108
Idaho	1,538,178	307,636	404,755	2,250,569
Illinois	5,095,276	1,019,055	2,579,163	8,693,494
Indiana	3,063,178	612,636	1,270,383	4,946,197
Iowa	3,200,927	640,185	1,362,859	5,203,971
Kansas	3,283,179	656,636	1,271,424	5,211,239
Kentucky	2,299,072	459,814	894,871	3,653,757
Louisiana	1,791,188	358,238	777,845	2,927,271
Maine	1,089,359	217,872	338,735	1,645,966
Maryland	1,018,447	203,689	506,840	1,728,976
Massachusetts	1,725,964	345,193	1,021,971	3,093,128
Michigan	3,784,165	756,833	1,620,378	6,161,376
Minnesota	3,402,720	680,544	1,313,891	5,397,155
Mississippi	2,196,926	439,385	777,444	3,413,755
Missouri	3,774,930	754,986	1,496,333	6,026,249
Montana	2,553,444	510,689	653,267	3,717,400
Nebraska	2,579,115	515,823	871,434	3,966,372
Nevada	1,590,172	318,034	243,750	2,151,956
New Hampshire	609,375	121,875	243,750	975,000
New Jersey	1,662,041	332,408	972,568	2,967,017
New Mexico	1,993,177	398,635	419,200	2,811,012
New York	6,105,009	1,221,002	3,345,530	10,671,541
North Carolina	2,919,413	583,883	1,242,912	4,746,208
North Dakota	1,939,847	387,969	776,153	3,103,969
Ohio	4,517,858	903,572	2,087,464	7,508,894
Oklahoma	2,928,955	585,791	1,125,334	4,640,080
Oregon	2,048,413	409,683	565,844	3,023,940
Pennsylvania	5,291,737	1,058,347	2,826,864	9,176,948
Rhode Island	609,375	121,875	243,750	975,000
South Carolina	1,671,209	334,242	736,174	2,741,625
South Dakota	2,029,328	405,866	674,361	3,109,555
Tennessee	2,616,339	523,268	933,280	4,072,887
Texas	7,787,739	1,557,548	2,674,043	12,019,330
Utah	1,410,802	282,160	321,103	2,014,065
Vermont	609,375	121,875	243,750	975,000
Virginia	2,269,875	453,975	935,084	3,658,934
Washington	1,956,342	391,268	750,582	3,098,192
West Virginia	1,357,927	271,585	652,386	2,281,898
Wisconsin	3,030,337	606,067	1,220,638	4,857,042
Wyoming	1,559,860	311,972	331,769	2,203,601
District of Columbia	.....	.....	243,750	243,750
Hawaii	609,375	121,875	243,750	975,000
Puerto Rico	609,375	121,875	360,341	1,091,591
TOTAL	$121,875,000	$24,375,000	$48,750,000	$195,000,000

Regional Authorities Will Only Plan

Revised Mansfield-Rankin bill expected to drop power-generation provisions

Work of re-drafting the Mansfield bill to set up regional authorities to deal with the Nation's water resources is progressing well and it is anticipated that a revised version will be submitted to the House Rivers and Harbors Committee early in the present session of Congress.

As revised, the bill is expected to provide only for regional planning authorities, without disturbing the functions of existing federal or state agencies and without the inclusion of power authorities modeled after the Tennessee Valley Authority. These regional bodies, it is believed, will review the plans of the Corps of Engineers, the Bureau of Reclamation, the Biological Survey, and other federal agencies contemplating the construction of projects on the various river systems, as well as similar plans of state and local governments, in order to call attention to any duplication of effort or conflict between objectives.

The regional bodies will report to the President through the National Resources Committee or its successor, and findings will be transmitted to Congress for consideration in authorizing projects and making appropriations to carry them out.

Opposition to power

Opposition to the original bills introduced by Rep. Mansfield of Texas and Rep. Rankin of Mississippi, as brought out in a series of committee hearings held during the special session, was directed almost entirely at the proposal to set up power authorities empowered to build dams and develop hydro-electric energy. These authorities, it was pointed out, would supersede the existing federal agencies, which have accumulated a vast fund of experience and have functioned up to the present with great satisfaction to the public interest.

It is interesting to note that the new set-up will continue, on a regional basis, the study of river improvement already published by the Water Resources Committee of the National Resources Committee, of which a revision is now in preparation. This lists, in their order of importance, proposed improvements on all major U. S. rivers, whether sponsored by federal, state or local governments, and evaluates the importance of the various water-control and water-utilization problems for each stream.

U.S. Court Paves Way For New Rate Basis

Wording of decision indicates changed views giving less weight to reproduction costs

President Roosevelt's historical cost basis for utility rate valuation has passed its first Supreme Court test, if not with victory, at least with the clear indication that the 40-year-old standard established with the 1898 decision in *Smyth vs. Ames* is open to amendment.

In a 6 to 2 decision written by Chief Justice Hughes (Justice Cardozo did not participate) the court on Jan. 3 reversed a California Federal District Court decision setting aside a gas rate schedule prepared by the California Railroad Commission for the Pacific Gas and Electric Co. and remanded the case to the lower court for a determination as to whether or not the proposed rates are confiscatory.

As pointed out by Justices Butler and McReynolds in a dissenting opinion, the District Court had held the rates invalid solely because the Railroad Commission, in valuing the company's property, did not consider reproduction cost.

The question before the Supreme Court, as pointed out by the Chief Justice, was "whether the Commission in its procedure, as distinguished from the effect of its order upon respondent's property rights, failed to satisfy the requirements of the Constitution."

As to methods: "When the rate-making agency of the State gives a fair hearing, receives and considers the competent evidence that is offered, affords opportunity through evidence and argument to challenge the result, and makes its determination upon evidence and not arbitrarily, the requirements of procedural due process are met, and the question that remains for this Court, or a lower federal court, is not as to the mere correctness of the method and reasoning adopted by the regulating agency but whether the rates it fixes will result in confiscation.

"The main issue in this litigation is whether the rates as fixed by the Commission's order are confiscatory. The District Court did not determine that issue. The District Court should determine it."

The significance of this decision lies in the fact that the railroad commission based its findings largely on money investment. By instructing the lower court to confine its findings to the question of confiscation, the Supreme Court opened the way for a finding that a value based on actual investment rather than reproduction cost will not result in confiscation.

Indianapolis Water Case Back to District Court

The Indianapolis water rate case, long the subject of contest in the lower courts, was sent back to the district court by the U. S. Supreme Court on Jan. 3 for further hearing and for a decree based on experience, since the district court's former findings in operating the company under rates set by the Indiana Public Service Commission.

The case is involved. It centers around rates fixed by the Indiana Public Service Commission for the Indianapolis Water Co. and action taken in the lower courts relating to the question of whether the rates are confiscatory. The district court set a value with respect to which it held the existing rates were not confiscatory and declared that the value would hold for a reasonable time in the future. By the time the case came to be decided in the Court of Appeals many months had elapsed and the latter court, while declining to overrule the lower court, observed that speculation as to future conditions had changed to experience and noted that there had been a continual rise of commodity prices in the intervening months. On this indication of a belief that the value should be increased or that the rates might now be declared confiscatory, the company took the case to the Supreme Court.

The Supreme Court has sent it back to the district court for further findings in the light of recent experience without a ruling on the questions at issue.

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Bituminous Emulsion Sale Does Not Infringe Patent

The holder of a patent on a process may not use his patent to obtain a monopoly on the sale of unpatented articles used in the process, the Supreme Court held in a decision made Jan. 3.

The Barber Co. holds a patent on a process for using bituminous emulsions, an unpatented article, to retard evaporation in the construction of cement concrete pavement. The company does not build roads or grant licenses to roadbuilders, but it allows roadbuilders purchasing its bituminous emulsion to make use of the patented process.

In the present case the Barber Co. brought suit against the Leitch Manufacturing Co., asserting that the Leitch Co. was guilty of contributory infringement of patent when it sold bituminous emulsion with the knowledge that it would be used in the patented process.

The court held that the Barber Co. sought an unwarranted extension of the rights granted to it by its patent and held that the Leitch Co. was not guilty of infringement.

Subway Contractor Wins Big Claim

Mideastern Contracting Corp. awarded $782,000 excess costs and interest for Brooklyn-Queens line

A jury of five women and seven men awarded the Mideastern Contracting Corp., New York, $552,700 on two items of a ten-part claim against the city of New York for excess costs in connection with the construction of the Newtown Creek tunnel section of the Brooklyn-Queens crosstown subway. The other eight items were compromised out of court for a total of $16,095, and interest on the entire award amounted to $213,014, bringing the total to $781,809. The trial, held in the Supreme Court of New York State and County before Justice McGoldrick, lasted nearly six weeks, ending on Dec. 21.

The original claim on the items settled out of court amounted to $176,790, compromised for $16,095. The items were for retained percentage, retention for backfill guarantees, extra cleaning of cast iron lining, underpinning, and extra excavation and concrete.

The principle item carried to court was for extra cost claimed by the contractor because the city Board of Transportation engineers demanded that shields be used in certain portions of the tunnels against the contractor's wishes; the other item was for cost of erecting and demolishing concrete bulkheads ordered by the engineers but considered unnecessary by the contractor.

Shields in specifications

The plans and specifications called for cast iron tunnel lining in the soft and mixed-ground areas, and the specifications further required: "Excavation for the cast iron lined tunnel shall be made by means of shields at the northerly and southerly ends of the section . . . elsewhere excavation for the cast iron lined tunnel may be made either by shields or by use of other methods approved by the engineer.

The jury, entirely of non-technical laymen, had to decide from the testimony whether the shields were actually needed or whether the cheaper methods suggested by the contractor would have been satisfactory. It also had to decide whether the engineers were justified in ordering the bulkheads placed.

James E. Gibbons, president of the Mideastern Contracting Corp., presented most of the testimony for the plaintiff; Nevius, Brett & Kellogg were attorneys. The case was defended by Geo. H. Mitchell, assistant corporation counsel, aided by R. S. Bennett, assistant engineer for the Board of Transportation. The city will appeal.

LABOR NOTES

TWENTY cases involving decisions of the National Labor Relations Board have been passed upon by circuit courts of appeal or the U. S. Supreme Court. In fifteen cases the NLRB was fully upheld, three of these decisions being consent decrees. In three other cases the board's rulings were upheld with certain modifications by the court. In one case the board's order was set aside and in another the court refused to enforce the board's order. This summary of litigation was issued by the board on the occasion of the most recent decision in its favor, handed down Dec. 13 by the Ninth Circuit Court in the case of the Carlisle Lumber Co. In these twenty cases, the board's findings of facts were modified in only one case, and in no case has the board's orders been set aside because of faults in the board's procedure. In the eighteen cases in which the board's orders were upheld the courts ordered reinstatement of about 740 employees, of whom about 414 received back pay.

WAGE INCREASES for employees of the Tennessee Valley Authority were announced Dec. 27 as a result of negotiations between TVA and the Tennessee Valley Trades & Labor Council. The new agreement provides for increases of about 5 per cent for construction workers. Schedules for salaried workers are still under consideration. Other clauses provide for a 40-hour maximum work week, and time and a half pay for overtime for hourly workers. About 8,000 construction employees are affected by the wage changes which will boost payrolls more than $500,000 a year. Changes became effective Jan. 1.

NO WAGE INCREASES are provided for in a new agreement for 1938 negotiated between A.F.L. unions in Portland, Ore., and the General Building Contractors Association there. A joint statement by representatives of the union and the contractors' association stated that the present scales were kept in hope of encouraging construction in the Oregon area. The agreement also called for an arbitration board to settle all disagreements. The present Portland scale provides for $1.50 for bricklayers, $1.12½ for carpenters, $1.37½ for ironworkers and $1.25 for pile drivers and cement finishers.

INFORMAL AGREEMENT was reached by San Francisco contractors on the desirability of state-wide agreements with buildings trades and construction unions at the annual convention of the Northern California Chapter of the Associated General Contractors of America, this month. Joseph M. Casey, organizer for the Brotherhood of Teamsters appeared in the conference to present the viewpoint of organized labor and said that building trades council unions in the state are in favor of a plan for blanket agreements.

RACKETEERING in Cleveland building trades unions was charged by a grand jury which indicted the president of the Painters District Council there and his assistants and the president of the laborers district council. It was charged that these men had solicited and obtained bribes from builders on the threat of calling strikes. The grand jury began its investigation after charges had been made by rank and file members of the unions affected.

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Record Dredging Season At Fort Peck Dam

Dredging progress at Fort Peck Dam on the Missouri River in Montana during the 1937 season broke all previous records for this class of work. In 249 working days a total of 31,672,400 cu.yd. of material was pumped into the earth fill dam, a rate of 5,900 cu.yd. per hr. The dam now contains 82,320,000 cu.yd., and 23,000,000 cu.yd. remain to be placed. This yardage can easily be placed this coming season, completing the dam a year ahead of the original scheduled time.

The 1937 record, 15 per cent ahead of the 1936 output of 28,000,000 cu.yd. and far ahead of the 21,000,000 yd. placed in 1935, is all the more remarkable in consideration of the time lost in closing the center section of the dam and moving the four dredges and their attending plant from upstream borrow pits to downstream pits last June.

Rumors have been heard that the upstream toe of the dam is "kicking up." Inquiry made to Major Clark Kittrell, district engineer in charge of the project, reveals that there is no foundation for such rumors. Reference hubs placed at 200-ft. intervals on a line 150 ft. upstream from the upper toe show no tendency of the foundation to kick up at this point. Previous detail studies of stress conditions in the foundation and tests of foundation materials indicated the desirability of placing a berm at the upstream toe to increase the factor of safety. Much of this berm was placed this past season after pumping operations in the main fill were closed down by cold weather. Apparently the placement of the berm started the rumors of foundation movement.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

POINTING out the difficulties in planning a large-scale housing project without funds and a paid technical staff, Administrator Nathan Strauss of the U. S. Housing Authority has issued a plea that immediate provision be made for the support of local housing bodies. Of the 52 communities represented at recent conferences in Washington, which resulted in the tentative earmarking of funds under the Wagner-Steigall Act, 23 have as yet no financial support of any kind.

BOULDER DAM on the Colorado River, although originally scheduled for completion in 1939, returned to the federal treasury by the end of 1937 more than $2,000,000, according to a report by John C. Page, Commissioner of Reclamation. Although the firm power rate did not go into effect until June 1, 1937, and only one quarter of the generating machinery has been installed, the sale of power has already brought in more than $1,100,000. In addition, $906,090 has been paid by power purchasers as installments on the cost of generating equipment. At the present time the plant is turning out between 130,000,000 and 150,000,000 kw-hr. per month.

During 1938 it is estimated that power revenues will reach $2,500,000 and machinery payments will aggregate $1,000,000. Two additional generators will go into service during the coming year, and two more are already ordered—all of 82,500 kva. capacity.

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Fire in Form Work Destroys Bridge

The results of three months construction work on a $65,000 concrete bridge being built over Salt Creek on a highway between Springfield and Chicago near Clinton, Ill., were destroyed when the wooden forms around the piers and abutments were destroyed by fire. All the work on the bridge is believed to have been lost.

The bridge was a four span structure 400 ft. long. Open charcoal burners used to keep the concrete warm are believed to have started the fire. The bridge was being built for the state highway department under a contract held by the Thomas McQueen Co. of Chicago.

News continued on page 33

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Salvage From Sewage

The following comments refer to the article by Dr. Willem Rudolfs, on byproduct recovery from sewage which appeared in the Dec. 30, 1937 issue, p. 1055. EDITOR

Sir: There is value in sewage as there is gold in sea water but attempts at recovery are rarely successful as the cost of recovery exceeds the value recovered. Dr. Rudolfs concludes that the time has come to change our thinking from destruction of waste to conservation and recovery. That time has long been with us. Victor Hugo called it to our attention in *Les Miserables* when he wrote:

"A great city is the most mighty of dung makers. Certain success would attend the experiment of employing the city to manure the plain. If our gold is manure, our manure, on the other hand, is gold. Those heaps of filth . . . . They are the meadow in flower, the green grass, thyme, thyme and sage, they are game, they are cattle, they are the satisfied bellows of great oxen in the evening, they are perfumed hay, they are golden wheat, they are bread on your table, they are the warm blood in your veins, they are health, they are joy, they are life."

Death also lurks in sewage. It is more potent and more easily released than the "life" mentioned by Hugo or the "value" mentioned by Rudolfs. When its death-dealing characteristics have been overcome, attention can be diverted to the recovery of its life-giving values.

Dr. Rudolfs is a leader in the treatment of sewage for sanitation. His venture into the field of sewage treatment for wealth production raises hopes for a brilliant future. In the search for wealth from sewage its death-dealing characteristics should not and will not be forgotten.

H. E. BABBITT
Professor of Sanitary Engineering, University of Illinois, Urbana, Ill.

Sir: Dr. Rudolfs' article appears timely, when considering what has recently been going on in the industrial field. There may be some merit in the idea that many industries are now "in the black" because byproducts which were formerly regarded as wastes are now being recovered and utilized. Even in sewage treatment practice, as pointed out by the author, this trend seems to have been followed, particularly in recent plants, which utilize gas for heating and other purposes and for power generation, or to varying degrees produce a fertilizer base from air-dried or conditioned sludge. Perhaps this trend merely reflects the times.

Parenthetically, a contrary trend is noted in the field of garbage disposal, where fewer attempts are apparently being made to recover grease and fertilizer bases than was true some twenty years ago. The present tendency in this field is undoubtedly dictated by the difficulty in obtaining operating funds and in the widely fluctuating and competitive market prices for the byproducts.

At present the worth-while byproduct in sewage treatment is sewage gas. Also, it seems doubtful if much further utilization of the byproducts in sewage will be attempted unless there is promise of income greater than the additional cost of operation, maintenance and recovery. This condition, however, should only serve to stimulate further research.

GEORGE B. GASCOIGNE
Consulting Engineer, Cleveland, Ohio

Sir: Dr. Rudolfs touches on an age-old subject, which is fraught with interest to the worker in the sewage disposal field, and one cannot help but agree that the subject is worthy of serious consideration.

Dr. Rudolfs' viewpoint is quite clear to the sanitary engineer, but one cannot help but wonder whether the limitations of the matter have been defined clearly enough to give the casual reader a true picture. Probably the most serious objection to sewage as a raw material is the definite limitation of its quantity in any given community. If, for instance, a high-grade product, which has a ready market, can be developed from the processing of sludge, the production and sale of this product is certainly limited by the amount of sludge available.

At the customary (but sometimes misleading) allowance of 100 gallons per capita per day, a city of 10,000 persons produces one million gallons of sewage. This will weigh about 4,170 tons of which approximately one ton can be recovered as sludge, about one-third of which is inert mineral matter; the latter is supposedly useless so far as recovery of byproducts is concerned.

Therefore, it would seem that the usable portion of sewage, or the source of raw material is limited to from 600 to 700 lb. per 10,000 people, and, naturally, only a small part of this, so far as is known now, can be recovered in the form of a salable byproduct. This is, of course, subject to many variations, as, for instance, in cities where large industries of certain types are located, but it is at least something to be considered by the enthusiastic adventurer in this field.

The use of water (i.e. treated effluent) has been mentioned and this salvage, at the present time, is probably the one most widely practiced. The revenue from treated effluent used for engine and roundhouse water at Herington, Kan., is now meeting the fixed charges and operating costs of the activated sludge plant at that place. The city of Parsons, Kan., is also receiving some revenue from plant effluent sold to a rendering plant.

Yes, this is indeed an interesting subject, but, as the author aptly concluded, "Before the beacons are changed, we must be sure of our course."

F. M. VEATCH
Black & Veatch, Consulting Engineers, Kansas City, Mo.

Sir. Dr. Rudolfs' article is stimulating and challenging. I agree with him that our objective should be directed toward conservation rather than destruction.

As an immediate step toward that ultimate objective of recovery, utilization and conservation, do not industrial wastes present the most promising field? If municipal sewage contains valuable salvage products, then industrial wastes, on the average five times stronger, should be five times as valuable. With the application of modern scientific methods through efficiency and research, our objective of conservation can be achieved by preventing wastes through better manufacturing methods and more efficient utilization of

the raw products of industry; by actual recovery of byproducts before the waste is permitted to leave the plant; and, along the lines suggested by Dr. Rudolfs, by secondary recovery at treatment works before discharging into the stream.

Pioneering work in some industries has demonstrated existing possibilities, and profits are being realized from what previously went down the sewer. The distilling industry, for example, has developed a feed base byproduct as valuable as the distillate. And the milk industry, in the development of a wider application of its product, has discovered new processes which will greatly aid in the elimination of waste. The Textile Foundation is giving serious consideration to waste problems. Valuable inorganic products can be recovered in the mining industry, in oil production and refining, in the manufacture of chemicals and metal products.

I appreciate that practical methods are not now developed for every industry and that byproduct profit is not inherent in every waste. However, there is no question that potentialities exist, and therefore, I enthusiastically endorse Dr. Rudolfs' reorientation, emphasizing conservation. If the industrial waste problem is approached broadly along these lines, I feel confident that substantial values can be recovered and, at the same time, tremendous progress made in conservation of our water resources.

C. J. VELZ
327 North Avenue, Fanwood, N. J.

Ruby Dam Design

Engineering News-Record
330 West 42nd Street
New York

Sir: In your issue of Nov. 11, 1937, p. 774, you have a letter from W. J. McKeen, acting superintendent, department of lighting, Seattle, Wash., stating that the design the department is using for their Ruby Dam construction is not a constant-angle arch dam.

In *Western Construction News* for June, 1937, the city's proposed arch dam is shown. Later the contract was let on a slightly changed design. Both are plainly constant-angle arch dams up to spillway El. 1,500, designed in accordance with eight of the claims laid down in the original constant-angle arch dam patent issued in 1911. Mr. McKeen evidently did not trouble to look up what is meant by a constant-angle arch dam.

Mr. McKeen says also that "because of the dense population of the Skagit valley below the dam, the city of Seattle has insisted that safety be given the first consideration in the design of the dam". In this he appears to have forgotten that the light department engineers had designed a straight gravity dam and that the writer had considerable difficulties convincing them that an arch dam would be much safer and much cheaper. That this is so was shown in the writer's article in your issue of October 14, 1937.

LARS JORGENSEN,
Consulting Engineer, Berkley, Calif., Dec. 22, 1937

Rock Drill Dust Control

Sir: I find the article "New Rock Drill Dust Control" published in the Dec. 30 issue very misleading and not stating the facts. Based on a few meager and questionable tests, you have repudiated years of work by former New York state committees on the control of siliceous dust in rock drilling, and other agencies engaged in public health work.

We grant that wet drilling methods are used in other countries and in mine and tunnel work in this country, but silicosis still prevails. In many sections of the country operators have tried for years to reduce the dust hazard with wet drills. They have employed water curtains and all known wet devices, but they still insist that the workmen wear respirators. Yet, in the end, periodic X-ray examinations of the workers show that the dust has not been controlled and kept within safe hygienic limits.

Dust control with dry drilling was approved by the State of New York after the manufacturers of exhaust system equipment had complied with the code established by the state department of labor. The wet drill manufacturers and contractors had the same opportunities to comply with the code, but they waited on one pretense or another for over a year and a half before they "developed" this "new" method of wet drilling.

The tabulated results and dust counts (published in the article) taken while drilling with dry dust control methods point to a failure of this method of control. However, actual drilling operations that have been checked by the New York state department of labor, where the equipment was being operated according to instructions with dry dust control methods, the results have fully complied with state laws, and in no case was it necessary to use any but ordinary labor to operate the equipment.

Your article further states that with dry dust control considerable dust is left in the bottom of the drill hole. This is not the case if the correct drill is used, and observation of dust in the hole indicated that the correct drill was not used when the samples were taken. During the only publicly-witnessed demonstration of this so-called "new" method (Dec. 7 on the Park Contracting Co. job) the drills were operated at a very reduced speed and none of the holes was cleaned for loading. The drill steel had to be pulled out of the hole with the air feed reversed and the sliding cone pulled back so that a new grip was obtained on the steel, which was finally drawn through the accumulated muck in the hole. The drill steel was observed to have from 2 to 3 ft. of wet muck clinging to it as it was placed to one side.

The above is the only specific example of the one exposed glimpse that the general public and state officials were allowed. Do you think that this alone is sufficient evidence to warrant the proposed code, drawn obviously for companies who have failed to comply with the code now in force over a year, merely because they state that the approved methods cannot be practically applied to their particular work?

To clarify this situation, I suggest you request the consulting engineer who supervised the work for the Sixth Ave. subway contractors to write an article, based on actual facts, as to just how he conducted his tests of exhaust methods, the type of drill used, and the conditions under which the tests were conducted; also the conditions of the tests on the six special drifters, and the results attained by these special drills other than dust counts.

GEORGE S. KELLEY,
Vice-president, Kadco Corp., New York, N. Y., Dec. 31, 1937

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Editorial Offices at 330 West 42nd Street, New York
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ANOTHER CONSTRUCTION YEAR is ended. It did not measure up to some expectations, but it was not nearly as bad as current business commentators would have us believe. Engineering construction, which does not include residential building, increased 4 per cent in dollar volume—actually an impressive increase, in view of the inability of the utilities and the railroads to secure new investment capital and thus contribute to the private construction total. It will be remembered that the big question at the beginning of last year was whether private construction could take up the slack created when federal aid to local public works was reduced. That it did take up the slack is due to substantial increases in new factory construction and commercial building. Residential construction proved one of the disappointments, starting out strong but bogging down under high costs. Nevertheless housebuilding improved over the previous year, and there is still unanimity of opinion that it should go ahead toward greater advance during 1938. The new year offers new opportunities—for a revival of investment confidence so that private construction can go ahead, for a continued growth in local public works and less WPA, for more housing and for safer roads. The problems, political and economic, that will arise can be brought to satisfactory solution by a more liberal dosage of tolerance and good will on the part of government and business.

Forward

THE IMMEDIATE OUTLOOK as the new year opens is obscured by clouds, for the construction man as well as for manufacturer, merchant and citizen. Economic cross-currents are partly responsible, but in addition substantial numbers of the people have become uncertain of the sincerity and good sense of their governmental representatives, and they are unlikely to venture far into the future while they remain in this doubting state. Directly beyond the momentary uncertainty however lies a prospect of great promise. Resumption of work from its seven-year stagnation remains to be accomplished; construction in particular has a period of intense activity ahead, since the country as it moves forward will want reequipment and refurnishing on a huge scale. The depression shortage must be made up first of all, but real progress calls for more: Mere return to the conditions of 1929 will not suffice to bring us out of obsoletion, for even in that brisk period we had no surplus of facilities beyond the day's needs, whether in factories, in public improvements or in housing. Better physical plant is required for the work of a world that has advanced a full decade. Construction, whose task it is to provide this plant, therefore looks forward to a busy future.

Power Uncertainty Ended

WITHOUT DISSENTING VOICE the Supreme Court has just declared that there is nothing immoral or unconstitutional about competing with an electric utility. While many people suspected this to be the case, they will take comfort in learning that they were right. The decision removes obstructions that have blocked electric-service development, and opens the way for progress; both utilities and public now know better where they stand, and development can go forward free from legal question. Probably few cities will be foolish enough to go into the highly technical business of electric distribution; they might find it a costly experiment even apart from the complications of supply to satellite areas and provision of standby plant, which add an expense burden not easy to avoid. The utilities should be able to show that their skill, experience and business volume enable them to distribute most cheaply, especially when citizens insist on the same supervision over municipal as over company electric accounts and charges. Utilities can build up their systems on definite business calculation, while cities that are venturesome enough to undertake electric distribution can go ahead without legal hindrance. As a first effect, the fifty or sixty communities whose electric enterprise was held up by the suits just decided are no longer prevented from adding to current construction activity.

Filters for Chicago

AT LAST Chicago has made a definite financial move toward filtering its Lake Michigan water supply. An item of $4,545,000 has been included in the budget for a start on the proposed $20,000,000 South Side plant, which would furnish pure water to one-third of the city now receiving the worst supply. But the budget provision is only a first step, for, although various sets of plans based on elaborate tests have been drawn up, basic questions of policy still remain to be decided. For example, the size of the plant depends on whether water waste will be controlled and if so how much.

Reduction of the present consumption from 280 gal. per capita per day to 180 gal. is believed to be the maximum feasible; political opposition to waste control is so strong, however, that only part of this reduction is likely to be accomplished, and that only by degrees and probably not until filtered water is already in the mains. Again, location of plant is in question, for, while all possible sites have been investigated, public opinion may yet force a change from that chosen as cheapest and most logical. But, while many hurdles must still be surmounted, it looks as though the country's second city is at last on the way toward cleaning up its water supply.

Time to Cooperate

ENACTMENT of the silicosis law by New York state eighteen months ago raised hopes for an early solution of the silicosis control problem in rock drilling. So far these hopes have not materialized, for no system of rock drill dust control has been developed that is accepted by the state authorities as effective and by the contractors as practical. It is time for the several interests concerned to forget their disagreements and cooperate in working out a solution.

Today the drill dust control situation is muddled and confusing. The law was weak initially, in requiring the use of something that did not exist; the state blundered and delayed in administration; the method most familiar to contractors, wet drilling, did not receive state approval; exhaust systems, which were approved, did not meet with contractor acceptance.

The act prescribed that after a certain date approved dust-control methods must be used in all rock drilling. Yet it was not until five months after the act became effective that the state was ready to conduct tests for approval of dust-control apparatus; the delay is significant of the unreadiness of the art and the unpreparedness of the state authorities. Three manufacturers of exhaust equipment then submitted devices, and the state after test approved certain of them under specified conditions. However, their adoption in actual rock drilling was slow, and many contractors considered them not practical for underground work, such as tunneling or subway construction.

Rather naturally, the contractors desired to continue with wet drills as a means of dust control. However, they were let down by the drill manufacturers, for, although wet drilling is standard throughout the world for reducing the drill dust hazard, the makers of drills failed to apply to the state for approval. Consequently, for a year past New York state contractors have been compelled to use dry drilling with exhaust systems or else they violated the law. Most of them continued to use wet drilling; a few were cited for violation of the law, over their protest that they were being subjected to a racket by the state officials.

A group of subway and tunnel contractors in New York City finally forced the issue after trying out the approved exhaust devices. Engaging a mining engineer, they developed a system of wet drilling and face ventilation that shows every promise of keeping the dust concentration within safe hygienic limits, as reported in last week's issue. The state however has not yet approved it, and confusion is as great as before.

In this situation bickering will get nowhere. There is a big problem to solve—the control of dust in rock excavation—which can be solved only with the cooperation of all concerned.

The state, knowing that wet drilling with ventilation is in successful use elsewhere, should not delay in acting to approve, or if necessary condemn, the system. This would clarify the situation. The U. S. Bureau of Mines, which was represented at the trials of the system, could helpfully cooperate in passing on its effectiveness. Approval of wet methods would not rule out the exhaust systems, especially if their makers improve them, as they say they can, to make them practical for heavy underground work.

The drill manufacturers can do much to cooperate. They have finally requested approval of all types of wet drills, based on studies made the past few months in an experimental mine. However, the basis of their request differs from that proposed by the contracting group. The contractors claim that less ventilating air is required than is recommended by the drill makers, and further believe that a slight adjustment of drill throttles and valves will greatly improve the effectiveness of the wet method. These contentions are entitled to consideration.

Lastly, all contractors can cooperate by realizing that there is a silicosis law on the books and that they are required to control drill dust. All too many are prone to belittle the silicosis hazard, and try to obstruct rather than work with those who are sincerely endeavoring to solve the problem.

There is one additional problem of cooperation: Before wet drilling can be adopted as a means of dust control, the present industrial code will have to be amended. Two proposed amendments are before the state. Both deserve careful study in order that the final draft of the new complete code, for both exhaust and wet methods, may be adequate and fair to all. If all parties cooperate in seeing that the amended code is adequate and effective, it may well serve as a standard for the country, as has the sound and justly-famous New York compressed air code.

PICTURES IN THE NEWS

Bronx Whitestone Parkway Bascule
Northern Boulevard bridge being built half at a time
Elevated Railway
Roosevelt Ave. double-deck bascule
L.I.R.R.
Tidegate and bridge at World's Fair site

Rudy Arnold Air Photo

BRIDGE BUILDING BOOMS in lower reaches of Flushing River adjacent to World's Fair site at New York. Whitestone Parkway bridge at the river mouth provides a completely new crossing near the recently completed Queens asphalt plant, one of largest and finest in country. Next upstream the old narrow Northern Blvd. crossing is being replaced by a modern structure. In foreground tidegate-bridge protects Fair lagoons from salt water and tide variations. Farther upstream the new Horace Harding Blvd. bridge is open to traffic.

A Statute for River Development

As a means of developing rivers for greatest total value, a federal law permitting the formation of interstate water control districts is proposed

The following is an extract of the address of Arthur E. Morgan before the Interstate Commission on the Delaware River Basin, in Philadelphia, Dec. 10, 1937, in which he outlined a procedure for unified control of interstate rivers. — EDITOR

PROJECTS for river control grow steadily in size, in importance and in complexity, and so long as the present technological development of our society persists that increase will continue. The control of floods will become more and more imperative; municipal water supplies will demand greater and more dependable water resources; industries will use constantly larger amounts of water in manufacturing processes; problems of pollution will more insistently press for solution; water power will be sought where it is profitable; steam power generating plants will need adequate condensing water; navigation will demand greater range and depth and greater uniformity of conditions; fish and other water life will be valued both for commerce and for sport; and the use of lakes and streams for recreation will grow with the increase of leisure time and with improvements in transportation.

Different needs often conflict

Our water resources are limited, and so are the means for using them. A large stream may have relatively few feasible dam sites. The available storage capacity may be needed for flood control, or power, for recreation, for industrial water supply, for controlling navigation conditions, for diluting pollution, and for other purposes. Some of these purposes may be achieved in combination in almost perfect harmony; certain others may conflict, or may be mutually exclusive.

How to meet these many and divergent needs, how to secure the greatest total value with the greatest possible economy, and with the least possible waste or loss of the total water resources—that in brief is the problem of unified river control.

Water control planning has been and must continue to be a practical process, depending upon common sense comparisons of values. It always will require a balancing of present needs against future possibilities, and a frequent surrendering of what we should like for what we imperatively must have. It must continue to be a process of give-and-take, of protecting as much as we can of potential values while getting as much as is feasible of present benefits.

For example, everyone wants our streams to be pure and uncontaminated, yet to demand that industry must suddenly do away with pollution would impose burdens too great to be assumed all at once. On the other hand, to see industrial pollution as a vested interest, the correction of which must be postponed to the dim future, is to surrender social control of precious and unique public resources. The wise course will be somewhere in between, in a policy of vigorous and aggressive action, tempered by a common sense appraisal of the burdens which can reasonably be imposed in the removal of pollution.

Interstate problems

The control of river systems, especially of interstate streams, is looked upon as a function of the federal government, to be directed by federal appointees and to be paid for with federal funds. The most conspicuous examples of this tendency are the Tennessee Valley Authority and the Columbia River project. This method of river control has some very great benefits and some very grave disadvantages.

Insofar as unified, multipurpose river control is concerned, state lines as a rule are arbitrary lines which do not conform to the realities of drainage areas. Effective administration of such river control on interstate streams must be interstate or superstate in its character.

Apportioning cost to benefits

The federal government has neither the power nor the administrative machinery to apportion any part of the costs of improvement to private real estate in proportion to the benefits received. In case of irrigation projects where the cost can be repaid by the income from water sold, this objection may be of minor consequence. The same may be true in case of water power developments where the sale of the product can be made to pay the cost. It is conceivable, and in my opinion would be highly desirable, that navigation improvements also, both of our ocean harbors and of our inland rivers, should be paid for, at least in part, through a reasonable period of time by the charging of fees, as is the case now with the Panama Canal. It would be as reasonable to charge fees to boats operating in New York harbor, which is improved at public expense, as it is to charge fees to autos going under the harbor through a tunnel.

In many cases, however, especially on flood control projects, private or local benefit is conferred at public expense. Great tracts of land owned by private corporations have been reclaimed or protected at public cost. Local communities, likewise, are protected and improved with federal funds. In a proposed water-control policy which I submitted to the

Water Supply Commission of Pennsylvania in 1915 I made the following statement, which I will quote to indicate that my views on the subject are not of recent origin.

"A fundamental necessity in any sound policy for water control is this—that the people who get the benefit shall pay the costs. Whenever work of only local benefit is paid for by state or national funds, the incentive to economy is removed and the way is open to the most flagrant violations of sound principles of public business.

"If the state, from its general revenues, pays for works of only local interest, the demand for such expenditures will be unlimited, or will be limited only by the ability of any community to secure favorable action by the legislature . . . . Moreover, such a policy actually retards development, for the people of a community commonly will not help themselves so long as there is even a remote possibility of their getting someone else to pay the cost."

In an address on principles of river control at the annual meeting of the American Engineering Council, I expressed a similar opinion:

"Looking ahead in the United States for the next twenty years, we can see that the development of our internal waterways will be a great national issue. How can we but bring about that development? Some would like the federal government to pay the entire cost. That method would be very welcome to every particular locality that needs help, but the resulting expenditures would run into many billions of dollars, and political log-rolling or autocratic bureaucracy would reach a development far beyond anything we have known.

"We are on the threshold of a dangerous departure when we come to make it a national policy for the federal government to pay for local benefits in all parts of the United States. The tendency is very strong to spend money freely when it comes without cost. The only way to avoid our getting into that morass is to work out methods by which people who are interested in these developments can bear the part of the load which represents their relative interests and responsibilities, or else go without the improvements."

What kind of machinery?

We have a few continuing bodies of men qualified by training and experience, to see a problem of unified river control in its entirety, and to bring about effective and coordinated development for all significant purposes in good proportion. When one observes the special pleading, the bureaucratic competitions for power, the near approach to nature faking, and the scramble for local appropriations which have marred public efforts for unified river control, it is evident that great resources and great enthusiasm alone are not enough, and that the specialized interests and skills of specialized state or federal departments are not enough, but that there must gradually emerge one or more experienced and disciplined organizations which will see the problem as a whole, without special interest, fiction or fantasy, and in good perspective and proportion. Such organizations as state water control commissions, regional planning authorities, and a national resources board, in general would seem to be our best hopes to the end of over-all planning and supervision.

The next rational step would be to enact a federal law providing for the organization and administration of federal interstate water-control districts. Such a law should cover water control for all purposes. It would apply to entire river systems, or to substantial tributaries of such systems in case their problems are largely independent. It could come into effective operation in either of two ways. The act itself could provide that it would be effective wherever two or more states should make a compact agreeing to its terms and providing for its application.

The need for a federal water control district law will become constantly greater. The alternative course, payment of the cost of local non-liquidating benefits from general funds, will surely lead to "log-rolling" and to political manipulation on such a vast scale as to threaten the survival of our government.

A water-control statute

Let me outline briefly the provisions of such a possible federal water-control statute.

When it should be desired to set up an interstate water control district for such a watershed as that of the Delaware River, a petition would be presented to the Federal Court of Appeals of the district where all or a substantial portion of the watershed lies, asking for the organiation of an interstate water control district. This petition could be initiated by any substantial interest, as by a state through its legislature, or by a substantial part of the cities or counties involved, or by other substantial interests as provided for in the act. The petition would describe in general the boundaries of the area proposed to be included, and the purposes to be served by the improvement.

A hearing would then be had before the court, or by a commission of masters or judges assigned by the court, to determine whether the petition was adquate and the proposed boundaries suitable, and whether the tentative organization of the district would be in the public interest. If the court should tentatively approve the petition it would appoint a director or a board of directors to administer the proceedings and a board of appraisers to determine benefits and to allocate costs. It probably also would authorize a very small ad valorem tax levy against the political subdivisions involved, to defray the cost of surveys, plans, and other expenses previous to the conclusive creation and financing of the district.

The director or directors then would prepare an initial plan or program for the district, and a working outline of policy for the use and administration of its waters. In case of definite construction it would make plans and estimates of costs and income, and general estimates of cost in relation to benefits. The entire project would then again be subject to judicial review, and if the undertaking as a whole should appear to the court to be well advised, the district would be definitely established.

In the matter of financing its work and of meeting the costs of improvements, however, the district would have certain powers and obligations, defined by federal statutes or by state compacts, or by both. In case of expenditures which would not be liquidated by the direct sale of products or direct charges or services, and which would not be covered by federal or state appropriations, it would be the duty of the appraisers to determine the benefits to be received by cities, counties, corporations, and individuals, and to allocate the costs in proportion to the benefits, the appraisals and allocations being subject to judicial review. The board of appraisers also should estimate the benefits and the proper allocation of cost to the federal and the several state governments for definite benefits received, but provision of funds to meet such allocations, at least in case of the federal government, would have to be made by appropriations.

Grouting Under an Earth Dam

Pine View Dam built on a porous foundation in which drains and a pipe system were installed for grouting after the fill had been completed

CONNECTING the bottom of sheet piles to rock by concrete, providing an elaborate drainage system over a porous foundation to permit placing earth fill in the dry and later grouting this drainage system, were some of the methods followed in constructing the foundation of Pine View Dam of the U. S. Bureau of Reclamation. Because of these and other problems the engineers have characterized the job, although comparatively small, as one producing as much concentrated grief as was encountered in many of the much publicized great projects. Located on the Ogden River, 10 miles east of the city of Ogden, Utah, at the head of a canyon well populated with summer-resort residents, no compromises with stability or safety were possible. The dam, recently dedicated, was filled to two-thirds of its depth last winter and showed a negligible leakage. In consequence the engineers have closed the construction chapter with a feeling of relief and the story can now be told without reservations.

The Pine View Dam was constructed for the purpose of storing the flood runoff for use on 22,000 acres of irrigated and irrigable land on the Ogden River Project in the vicinity of Ogden and Brigham City. The dam is of the rolled-earth and rock-fill type having a height of 61 ft. above the stream bed and 102 ft. above the level to which the cutoff trench was excavated. The crest length is 500 ft., the upstream slope 3 on 1, covered with 3 ft. of rock riprap, and the downstream slope is $2\frac{3}{4}$ on 1.

An open-chute type, concrete-lined spillway in the right abutment has a capacity of 10,000 sec.-ft. (three times the maximum flood of record) and is controlled by three radial gates. The diversion tunnel is also located in the right abutment, as is a tunnel for the highway up the right side of the reservoir. The diversion tunnel is a pressure tunnel from the

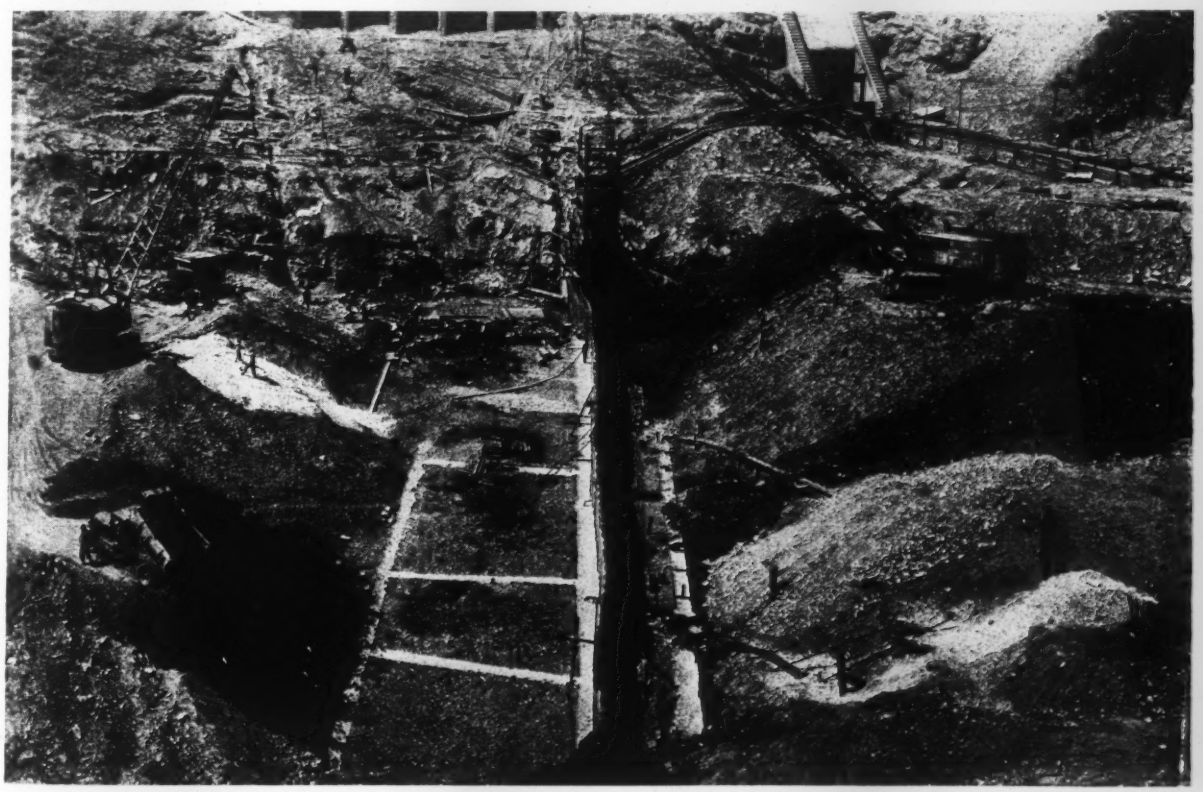

Fig. 1. Bottom of the cutoff trench with the sheetpile wall in the center and rows of gravel-filled trenches in which are imbedded the drain and grout pipes.

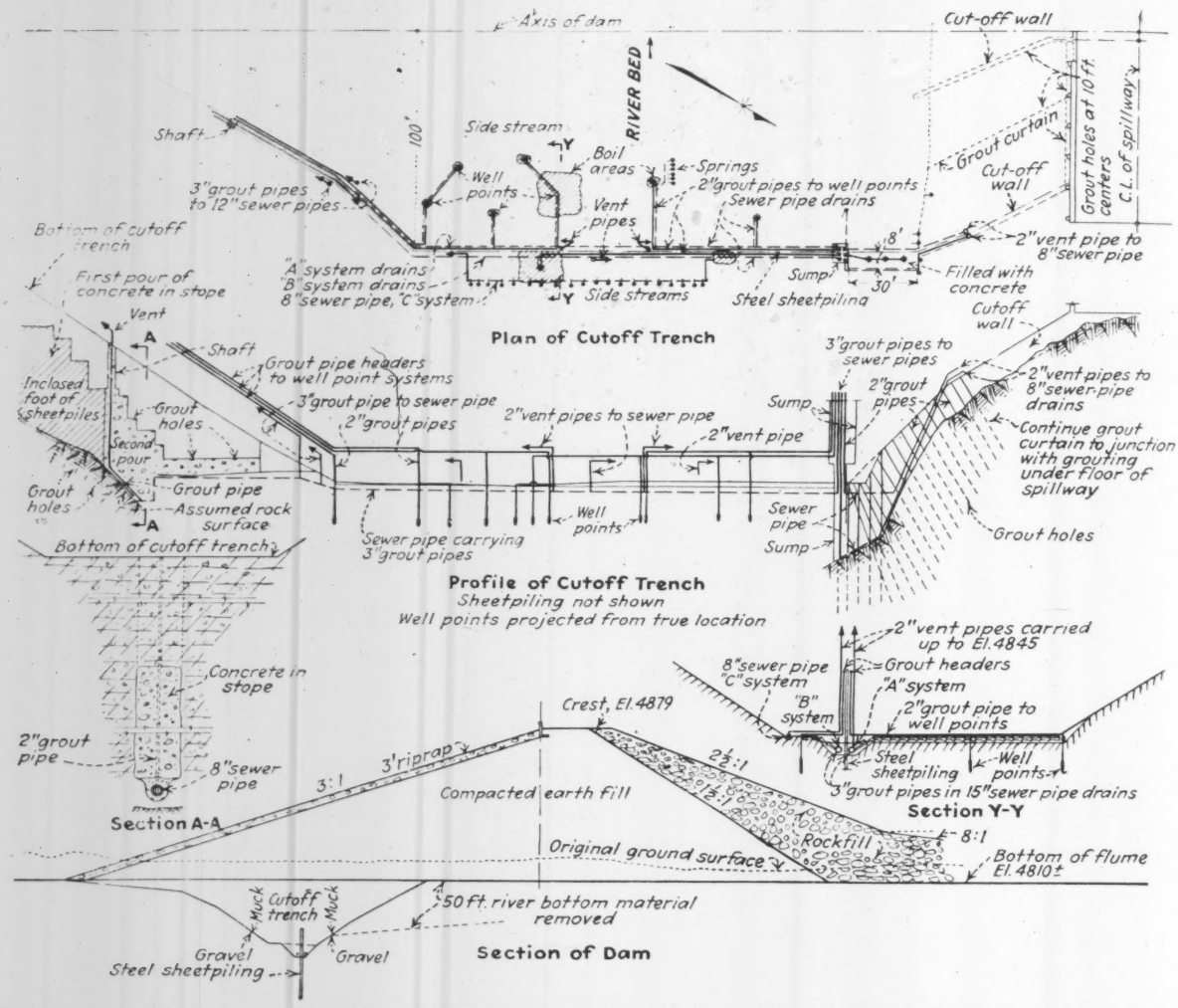

Fig. 2. Drain and grout system as laid out for Pine View Dam to keep groundwater from the fill during construction. The system as built departed in minor details from this layout.

inlet to the gate chamber below which the tunnel carries a 60-in. steel-pipe bypass to the spillway and a 72-in. steel-pipe penstock discharging water for power and irrigation uses.

The rock in both abutments is limestone and quartzite, badly fissured and broken at the surface but apparently quite solid underneath. The right abutment was stripped to bedrock, a cutoff trench excavated in the foundations and up the left abutment where the abutment has an overburden of gravels, sand and clay. A steel sheetpiling cutoff was driven to refusal in the cutoff trench and up the left abutment. In this abutment the sheetpiling was connected by a concrete wall in a stope to the bedrock. The cutoff was carried up the right abutment as a concrete wall from the end of the sheetpiling to the spillway structure with an auxiliary cutoff wall downstream. Because of the porous materials immediately adjacent to the bedrock at the right end of the pile cutoff and at the lower end of the stope in the left abutment, additional material was removed at these points and the excavation later filled with concrete.

It was necessary to construct a system of tile drains in the cutoff trench to permit the placing of the earth embankment in the dry. These tile drains led to a central sump from which the collected water was pumped until the fill was sufficiently above the static head to cause no further difficulty from this source. The subsequent grouting of this drainage system and a "spring area" in the right abutment presented the unsual features of the grouting program. Grouting at other points was more of a routine grouting procedure of no special interest.

Diversion tunnel

Only the pressure portion of the diversion tunnel was grouted. Following usual practice the high points of excavation of the arch of the tunnel were grouted first under low pressure (20 lb.). Cement used varied from 3 to 45 sacks per hole. Rings of high pressure (100 lb.) holes about 20 ft. deep and 15 to 16 ft. apart each required only a few sacks (½ to 24) of cement except in one hole which was 39½ ft. deep and took 168 sacks. These rings usually consisted of six holes, one each on the diagonals, one up and two horizontal (none down). A small amount of grout came through the construction joints in the tunnel lining but

no appreciable losses resulted. The small amounts used indicates a fairly tight condition of the rock surrounding the tunnel.

Spillway

A certain line of grout holes about 5 ft. apart under the spillway sealed the rock upstream from the gate chamber and connected with the grouting done on the cutoff walls. It forms a continuous line of grouted holes from the bottom of the excavated trench to the top of the spillway in the right abutment. The holes were first drilled 10 ft. deep and grouted. Below this depth the holes were grouted at intervals of 10 ft. depending on the existence of sizeable fissures as determined by water pressure tests. Eighteen of 31 holes took 5 sacks or less, one took 175 sacks, one 82, one 77 and the remainder much less.

Cutoff walls

Two cutoff walls and a grout curtain extended from the spillway down the right abutment. Most of the holes were 50 ft. deep but the first 10 ft. of each was grouted before deepening in 10-ft. steps. The surface 10 ft. needed regrouting in a considerable number of the holes and some calking of cracks and crevices was necessary. Very little grout came through to the gate chamber excavation and on the whole the rock was considered as having few openings.

Foundation and tile drainage

Early in 1935 the cutoff trench excavation and stripping disclosed the porous nature of the materials in the foundation resulting in moving the center line of the cutoff trench to 100 ft. upstream from the axis of the dam. As designed it was to have been 64½ ft.

The downstream section of the dam overlaps and rests on material brought down by Wheeler Creek and deposited as a fan in the river channel. This fan is composed of large water-worn boulders, gravel and sand with some admixture of finer materials. It is considered to be a rather porous but stable foundation material. Probably the depositions from Wheeler Creek kept ahead of the aggradation of the river channel above this point with the result that finer river drift materials were deposited upstream from the Wheeler Creek fan and in that portion under the upstream section of the dam. These materials ranged from porous heavy to fine river-gravel deposits with a fine dark colored silt deposited in pockets or lenses. Tests on this silt showed a dry weight ranging from 76 to 90 lb. per cu. ft. and a moisture content of from 30 to 43 per cent. In the left abutment was a body of light colored silty clay having a dry weight of from 95 to 100 lb. per cu. ft. and moisture content of from 22.5 to 31.4 per cent. Materials as a whole were deposited in lenses and pockets with no persistent stratification that prevailed for any great distance.

The overburden in the left abutment consisted of a surface layer of talus material, all removed in stripping operations. Below was found a layer of material composed of nearly horizontal strata of water-worn gravels and sands, very porous and extending the entire height of the left abutment. Between this layer and bedrock was a layer of talus material composed of angular rock and gravel mixed with clay but not in proportions to make it fully water tight.

The condition of the materials indicated a greater porosity and instability than that assumed from the

Fig. 3. The spillway of Pine View Dam is through rock at one abutment. Grouting was carried through this rock to insure its tightness.

earlier wash boring tests made in the first investigations of the damsite. A board of engineers consisting of Charles P. Berkey, W. F. Durand and the late D. C. Henny on June 21, 1935, recommended that the steel sheetpiling cutoff be moved upstream to 100 ft. from the axis of the dam and carried obliquely up the left abutment to a point at the top of the dam at the axis and that all piling be driven to bedrock. The sheetpiling in the abutment was to be sealed to bedrock by a concrete wall constructed in a stope. A concrete cutoff wall was to be carried up the right abutment from the sheetpiling to a contact with the spillway structure.

The relocation required widening the bottom of the cutoff trench (25 ft. deep) to 55 ft. All deposits of black silt, except those occurring in occasional thin lenses between gravelly river drift as exposed in the sides of the cutoff trench, were removed. Thus, the foundation of the dam is gravelly river drift with the exception of a small area in the bottom of the trench at the left abutment where the material is a light colored sandy clay.

The bottom of the stope in the left abutment, and the area immediately adjacent to the bedrock in the bottom of the trench at the right abutment, were composed of exceptionally loose talus which was removed and replaced with concrete.

Sand boils and springs

Numerous sand boils and springs developed on the floor of the cutoff trench in its entire length and some inflow occurred from the sides of the trench at elevations up to about 4 ft. over the bottom. These springs had considerable artesian pressure but had no connection with the artesian condition existing in the reservoir site (See *ENR* Oct. 31, 1935, p. 596) since the damsite is downstream from the cutoff dike which retains the artesian water under the reservoir. The largest single spring developed in driving a test pile in the south or left abutment. An inflow of 5 sec.-ft. was pumped from the cutoff trench; this removed a considerable amount of fines from the underlying gravels. Subsequent grouting through the well-point system was done with the object of correcting this condition.

In excavating the stope at the left abutment it was found that the overburden carried a large percentage of rock fragments and boulders mixed with the clay, sand and gravels. The condition presented too great an obstacle to the driving of a satisfactory sheetpile wall, the lower part of which showed many split interlocks and meandering piles. To make an effective seal the stope excavation was carried upward a maximum of 45 ft. in successive lifts until it reached above all split interlocks. Sheeting was necessary on some of the sidewalls and in the roof. The spaces back of the sheeting were grouted after concrete had been placed in the stope. In the floor of the stope grouting was delayed until a minimum of 10 ft. of concrete had been placed over the holes to be grouted, pipes being carried up through the concrete. All holes in the floor were drilled 10 ft. into the bedrock. None of these holes required much cement.

Drain and grout systems

Specifications required placement of the earth embankment at optimum moisture content. This requirement made it essential to drain the foundations and keep the water down until the embankment had been raised to a height of 15 ft. above the elevation to which the groundwater would rise with no water in the reservoir. To accomplish this, a tile drain system, largely 12 and 15-in. tile laid with open joints in screened gravel trenches, was installed in the bottom of the cutoff trench. The system consisted of three main lines, one each side of the sheetpiles and one at the toe of the upstream slope of the trench. An auxiliary side drain was placed at the toe of the downstream slope with several cross connections to the main drains. These drains discharged into a sump near the north abutment. A gate was attached to each inlet to prevent the inflow of concrete into the drains during the subsequent filling of the sump with concrete prior to grouting the drainage system.

During the installation of the drain system provision was made for subsequently filling the drain pipes and the surrounding gravel with grout. With the pressures used it was considered that some of the grout would be forced into the more porous parts of the foundation. Six-inch steel pipes, were connected to each system of tile drains and carried up through the sump to the elevation of the earth fill at that point. In addition, a 3-in. pipe was carried down the sump and threaded through the main of each drain system. Vents of 2-in. pipe were spaced at intervals and carried along the sheetpiling cutoff to points above the embankment level. The drain system in the stope was grouted through a separate 2-in. pipe. The 3-in. pipe laid in the drains was perforated with two ½-in. holes every 2 in. for 5 ft. in every 20-ft. length.

Grouting the spring

The spring area was located in the rock at the right abutment at the end of the vertical trench and sheetpiling cutoff and at about the elevation of the bottom of the cutoff trench. Apparently it consisted of a number of fissures or a broken rock passageway having its origin at some point upstream from the cutoff wall and discharging immediately below the cutoff wall. Two holes under the east upstream cutoff wall connected directly with the passageway, which carried about 0.5 sec.-ft. Attempts to grout this area prior to the placing of the embankment were unsuccessful even though cinders were used. Apparently the hidden channels were so large and the flow so great that the grout materials could not block the openings.

A concrete wall was constructed at the outlet connecting with the rock of the abutment, the steel piling cutoff and the concrete of the east cutoff wall. A perforated 6-in. pipe incased in screened gravel was installed in the space left back of the wall and the pipe extended through the wall to the sump and up the sump as a riser. This arrangement stopped all leakage and grouting took place along with the foundation grouting.

Right abutment trench

A vertical trench at the right abutment was excavated for the removal of the porous talus material. It was located so that the south end was later used as a sump, the bottom being about 10 ft. lower than the bottom of the cutoff trench. A line of sheetpiling 8 ft. away from the main

piling line and 30 ft. from the rock line inclosed the excavation. Well-points were driven for grouting in an attempt to prevent a repetition of a former blowout into the trench. Concrete was then filled in except for the sump in the bottom of which a 4-ft. layer of concrete was placed to seal off the springs.

Foundation grouting

For the foundation and well-point grouting it was decided to use a grouting pressure in pounds per square inch equal to the number of feet of height of embankment over the area being grouted. Neat cement grout only was used. A cement especially screened to remove steel particles which tended to clog the pump valves was used in the grout pumped. The "A" system, that located downstream from the sheetpiling, was grouted first then the "B" system, located immediately above the sheet piling, and the "C" system, the one fartherest upstream, last. Assuming the voids in the screened gravel trench around the tile at 50 per cent and adding this volume to that of the system, the "A" system held 1,345 cu. ft., the "B" system 878 cu. ft. and the "C" system 612 cu. ft. The actual volumes were somewhat less since in placing the fill embankment around the screened gravel and draining out the water prior to grouting considerable fine material must have entered.

Equipment assembled for the grouting operation consisted of the following:

1—concrete pump with a 21-S mixer
1—6x4x10-in. grout pump with agitator
3—6x4x6-in. grout pumps with agitator
2—7-S portable mixers
1—10-S portable mixer

In general the procedure was to fill each drain system as nearly full as possible with the concrete pump, the grout being pumped through under no excess pressure and delivered to the 6-in. header pipes leading to each system. This arrangement did not permit the development of a pressure in excess of the static head. Final filling under pressure was accomplished by connecting the grout pumps to the headers on the perforated pipes laid in the mains of the drains. It was considered best to operate continuously once started and to fill each system as rapidly as possible under the desired pressure.

Grouting the "A" system began Oct. 16, 1936, with the concrete pump connected to the 6-in. header with the connection open so that in case of a sudden filling of the drain system no more than the static head would result. Two of the grout pumps and 10-S and 7-S mixers were connected to the 2 and 3-in. perforated pressure supply headers. The placing of grout with a water-cement ratio of 0.5 to 0.75 was started through headers 6 (south) and 7 (north) in the "A" system at 8:45 a.m. The concrete pump started at 9:45 a.m. At 11:30 a.m. increasing pressure broke down one of the grout pumps which started again in 20 min. with the holding pressure rising immediately to 164 lb. At 1:30 a.m. Oct. 17, 91 sacks were placed in outlet header No. 7 to the right abutment by gravity flow before refusal under 90-ft. static head. Headers to the tile drain pipe in the "A" system took supply from the concrete pump until 2:20 p.m. when they refused under 68 ft. static head. One of the pressure pumps was then connected and it refused at 70 lb. at the pump or 126 lb. on the system. Header 6 to the 3-in. pipe within the "A" system of drains to the south took grout without pressure increase until 2:45 p.m. The water-cement ratio was then decreased from 0.75 to 0.6, the pump was speeded up accompanied by washing at intervals. This operation continued until 10:50 p.m. when a sudden decrease in pumping pressure from 45 to 20 lb. and a holding pressure reduction from 25 to 0 occurred. The drop was coincident with the appearance of grout through a 4-ft. fissure in the embankment a few feet upstream from the sump. At 2 a.m. Oct. 17 header 6 refused at 90 ft. and vent 2, near the south abutment, took 6 sacks before refusal at static head. This completed operations on the "A" system with 3,919 sacks placed having a computed set volume of 4,297 cu. ft. against voids of 1,345 cu. ft.

It was apparent that a portion of the "B" system was filled. Two headers and a vent on "B" refused to take water at 74 lb. On Oct. 31 grouting of the "B" system was completed at high pressures of 110, 116 and 200 lb. Only 230 sacks (300 cu. ft. set) were inserted into the system having a computed void volume of 878 cu. ft.

On the "C" system all pumps were operated simultaneously beginning at 11 a.m. Oct. 17. The system was full at 1:30 the next morning at maximum pressure of 90 lb. A total of 1,006 sacks (1,126 cu. ft. set volume) were inserted into the computed 612 cu.-ft. of voids.

Grouting the springs

Grouting the spring area and well-point systems followed on Oct. 19. Apparently the space back of the concrete wall had been filled when system "A" was filled. The well-point systems were usually given a light pressure wash with water before grouting which was started at a water-cement ratio of 3. One of these systems, No. 11, under a holding pressure of 75 lb. dropped suddenly to 66 lb. when a wet spot developed on the surface of the embankment 12 ft. downstream from the sump. Hole 21-A returned grout through hole 20-A, which was closed. A slow return also showed in 16-A. It later took grout slowly under 95 lb. A break similar to that noted above through the embankment was also encountered in grouting hole 17-A. A total of 364 sacks went into the spring area with maximum pressure of 138 lb. mostly at 68 to 70 lb., however.

Into the well-point systems went 1,443 sacks of cement. One group of springs, including the largest, took grout freely with a water-cement ratio varying from 2 to 1 until 554 sacks had been placed and the holding pressure built up to 102 lb.

On Oct. 21 all vents and headers were reconnected and 293 sacks placed in the entire foundation grouting system. The unfilled headers in the sump used six more sacks after they had been cut off 2 ft. above the concrete.

Conclusions and results

The 5,155 sacks of cement used in grouting the foundation drainage system and the set volume of grout placed is greatly in excess of the volume of the drains and voids in the screened gravel surrounding the drains. It is concluded from this that the excess went into the more porous gravels of the foundation.

Although the 6-in. header pipe to the "A" system of drains was filled,

additional grout was forced through the 3-in. perforated pipe at the desired pressure in sufficient amounts to justify the conclusion that the system and surrounding voids are completely filled. Filling the "B" system from the "A" system could be done by three possible courses of the grout: (1) Along and over the sheetpiling; careful compaction of the earth by power tamping rather precludes this possibility. (2) Through piling interlocks. (3) Down along the piling to a passage through the cutoff and then up along the piling to the "B" system. Fines had been removed from the gravels adjacent to the piling and the interlocks were far from being watertight. Probably the second and third routes were followed. With the pressures used it is certain that the interlocks were filled down to the limits of the unbalanced pressures as well as any "piping" in the gravel.

The assumed 1-lb. per foot of allowable pressures for grouting under embankment approximates the permissible limits. In some cases the embankment withstood a considerably greater pressure and in a few cases ruptured.

Grout traveled far

The travel of grout in the foundation conditions that existed exceed anticipations. The well-point system took about the anticipated amount of grout estimated from the apparent removal of fine from the gravel in the spring areas. The amounts placed indicated a much greater travel downward of the grout than anticipated. Computations indicated 2,835 cu. ft. of void space in the drains and gravel into which 5,723 cu. ft. of set grout was forced.

Leakage on filling the reservoir in January to 35.5 per cent of the full reservoir amounted to less than 0.6 sec.-ft. as determined by weirs placed below the dam. This is considered negligible by the engineers.

The Pine View Dam was constructed by the U. S. Bureau of Reclamation of which John C. Page is commissioner. All engineering and construction of the bureau is supervised by R. F. Walter, chief engineer, and J. L. Savage, chief designing engineer, located in Denver, Colo. J. R. Iakisch, with headquarters in Ogden, is construction engineer.

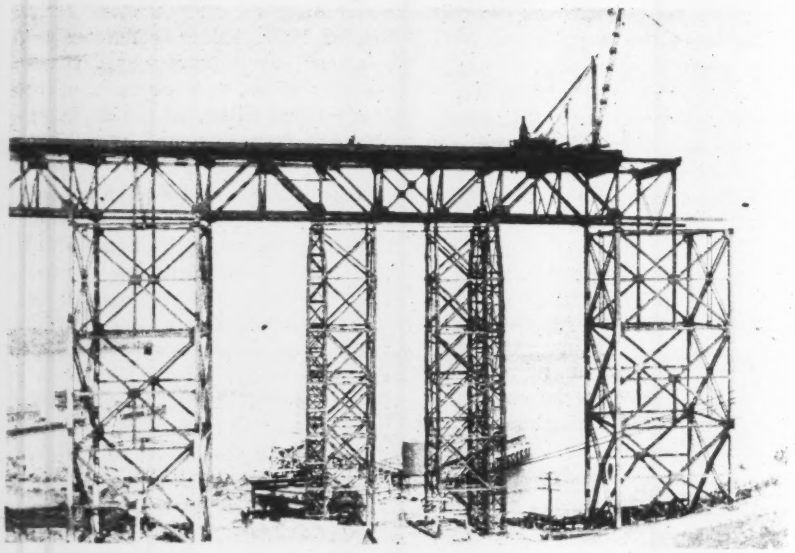

Fig. 1. Timber falsework of portable units for repeated use.

High Timber Falsework Units

Towers built of pre-assembled frames, convenient for removal to new settings, used in erection of Golden Gate Bridge approaches

TIMBER falsework built in units that could be moved and reassembled in new locations repeatedly was used in erection of steel approach spans on both the Marin and the San Fransicso ends of the Golden Gate Bridge. Falsework designed for repeated use was particularly economical because delay in construction of the south pier gave ample time for completing the approaches on the north end before work on the south was started. After work at the north end was finished the falsework units were moved to the south end, thus utilizing most of them in four successive set-ups.

On the south the approach includes a 320-ft. steel arch over Fort Winfield Scott, historic brick structure at the water's edge which it was desired to preserve intact. Other steel spans in the south approach are two of 125-ft., one of 175-ft., and three shorter girder spans. Similar erection methods were used at both ends except that the arch on the south called for special provisions. Timber posts and bents for the arch falsework were set up close to the face of the fort wall and ¾-in bolts were put through its 5-ft. brick wall at gun ports, thus making it possible to clamp the falsework uprights on the outside to timbers placed crosswise on the inner face of the wall.

The essential unit, which was the basis for falsework under trusses and arches alike, was a timber frame with a horizontal section 8 ft. square and a vertical length of 22 ft. The corner posts were 12x12s and the diagonal bracing, for the most part 4x12s, was entirely on the outside of the square frame thus leaving the inner faces of the 12x12s free for putting on 4x12-in. splice timbers or scabs. These 22-ft. units could be handled conveniently by the derrick rigs, and by the use of bolts instead of spikes for all joints between units the dismantling and setting ahead in a new location did not damage the units nor require a great amount of time.

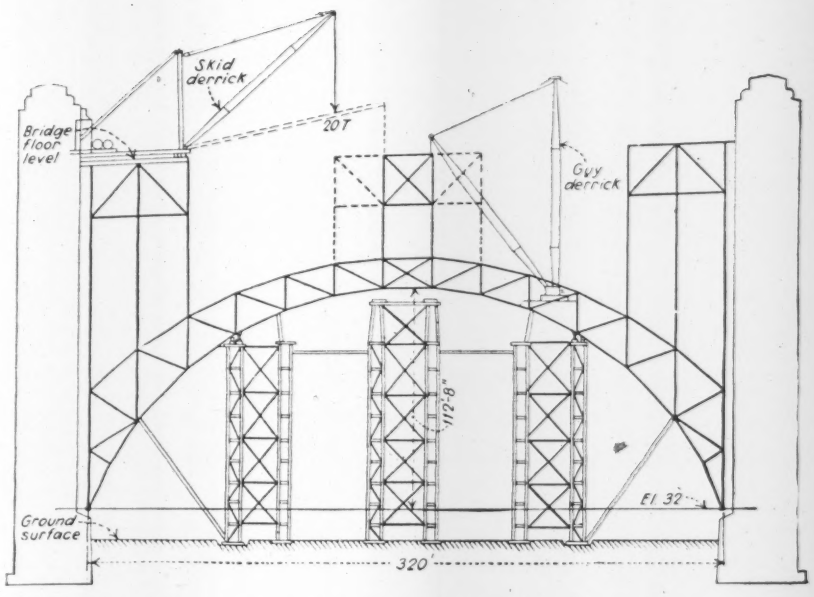

Fig. 2. Arrangement of falsework and derricks for steel erection in the 320-ft. arches combined with bents to provide lateral stability.

Supplementing towers built of these rectangular units, timber bents assembled in advance in 22-ft. lengths also were used. The joints between successive lifts in the bent assembly were similar to those in the towers and all bracing between tower and bent was bolted to simplify removal and assembly at a new location. Because of the longer spans on the north end a combination of towers and bents was used in each span. On the south end, where the spans were only 125 ft., a single tower under each truss was all that was required. For the arch span three combinations of towers or towers and bents were used under each of the two arch ribs.

Under each 175-ft. span falsework was erected so as to bring a timbered tower under the panel points 50 ft. out from each end of the span. The trusses were fabricated with field splices just beyond the second and fifth panel points. As the panels were 25 ft. long this made it possible to erect a 175-ft. span in three successive placements, that is, portions of the truss went up in lengths of 50, 75, and 50 ft., respectively. The sequence of this placement is illustrated in Fig. 1 in which the erection proceeds from left to right. Falsework of the general arrangement there shown was used up to maximum heights of 160 ft. and was designed to carry a total load of 100 tons.

The spans of 125-ft. length have five 25-ft. panels and their maximum height is about 130 ft. above ground level. In these spans only a single falsework tower consisting of the 8x8x22-ft. units without an adjacent bent, was erected under each truss, and this single tower was set 50 ft. from the end on which the erecting derrick was working. In this location the tower was immediately under a panel point. Part of the erection scheme was to have the field splices made just beyond a panel point. The first length of slightly more than two panels (50 ft.) was lifted to place in a single piece and was set with its forward end supported on the falsework tower. After the corresponding parts of both trusses were in place and transverse bracing had been put in, the derrick moved out to a position over the tower and from that point placed the remainder of the span, thus completing each truss in two lifts.

Under this program steel erection proceeded at a rapid rate. The average for the job, consisting of the total for two derrick crews, was 170 tons per 8-hr. day. This rate of erection was possible, it is believed, only because the falsework was assembled in advance in unit form. It required only two days for the crew to remove the falsework and set it up in the next position ahead, much less than would have been needed on work at this height if preassembled units had not been used.

In erection of steel arches the same falsework units were employed and the erection sequence was as shown in Fig. 2. The skid derrick at the left moved out at bridge floor level setting three sets of posts cantilevered from the concrete pylon. Meanwhile the guy derrick at the right supported on the falsework tower, set the corresponding posts on the other end of the span.

The second step was the erection of the three panels over the crown of the arch, followed by filling in the remaining space ahead of the traveling derrick and, as much as possible, the arch was closed, all blocking to the falsework was released and the remainder of the assembly was done by the skid derrick at deck level.

Contract for erection of the approach steel was held by J. H. Pomeroy & Co., Inc., of San Francisco, and the Raymond Concrete Pile Co.

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Service Costs Rise In Large Cities

THE per capita cost of operation and maintenance of general departments of city governments of the 94 cities having a population of over 100,000 was $48.83 in 1936 as compared with $47.78 in the previous year, according to a recent report by William L. Austin, director, Bureau of the Census, Department of Commerce.

Cost payments for operation and maintenance of general departments, including those for the independent districts, totalled $1,838,803,017. In addition, payments amounted to $143,371,588 for operation and maintenance of public service enterprises: (water works, electric light plants, and similar services), $234,671,028 for interest on general debt; $119,443,707 for interest on public service enterprise debt; and $438,737,948 for outlay, of which $144,082,808 was for public service enterprises.

The gross debt outstanding at the close of the fiscal year for the 94 cities was $8,286,222,906 or $202.03 per capita. The valuation of taxable property in the same cities, subject to ad valorem taxes for city corporation was $57,012,931,855, or $1,514.00 per capita.

Difficulties in Administration of Silicosis Compensation

Wisconsin's eighteen-year experience discloses some of the troubles in satisfactory handling of silicosis disability cases in that state

Administration of silicosis compensation acts is one of the most serious problems in connection with the occupational disease. While compensation for silicosis is new in most states, Wisconsin has recognized the disease as compenable since 1919. Max Kossoris, of the U. S. Bureau of Labor Statistics, has outlined Wisconsin's experience in the recent Monthly Labor Information Bulletin, from which the following article is taken. — EDITOR

THE PROBLEM of compensating workers disabled because of silicosis presents many more difficulties than that of compensating for the usual type of industrial injury. In accidents the injury to the worker is instantaneous and beyond question. Silicosis, on the other hand, develops slowly over the years during which the worker is exposed to silica dust.

Medical opinion indicates that not often do workers die from silicosis, but rather that the disease weakens their lungs, and that infection, generally tuberculosis or pneumonia, sets in much more easily and often terminates fatally for the diseased worker. But even after silicosis has developed, it is, except in advanced cases, not disabling to the worker. If shifted to an occupation which does not involve exposure to silica dust, the worker may never reach the stage of complete disablement.

Because of the slowness in the development of silicosis and the fact that a worker affiicted with the disease may have changed jobs several times before being disabled, the question as to which employer shall be responsible for meeting the claim of the disabled worker for compensation benefits was raised very early before the Industrial Commission of Wisconsin. Shall it be the last employer who exposed the worker to silica dust, or shall the compensation to be awarded be pro-rated among all employers for whom the individual worked during the development of the disease?

For practical reasons, it was decided that the last employer should be held liable for the total amount. But suppose the worker came down with silicosis while working for an employer at a job which did not involve exposure to silica dust, could he then get compensation from his present employer? The Supreme Court of Wisconsin decided that he could not. Could the employee then recover from the last employer who exposed him to silica dust? The court held that he could not bring a claim against such a former employer because he had not been disabled while working for that employer. Under such circumstances, then, a worker could not obtain compensation from anyone.

As a result of these decisions many workers wholly or partially disabled by silicosis were unable to collect compensation for their diseased condition. Many of them were discharged by their employers after medical examinations disclosed some stage of silicosis. Such dismissals were often made at the insistence of insurance companies who did not want to pay the entire costs of compensating a worker should he finally be disabled by the disease. For similar reasons other employers have refused to give employment to workers with partially developed cases of silicosis.

Changes in the law

Several legislative attempts have been made to overcome some of the difficulties of determining the employer's liability for the diseased condition of his former employees. In 1933 an amendment to the Wisconsin law made it possible for disabled workers to collect benefits although their disability developed after they had been discharged or laid off by the concern which last exposed them to the disease. The Wisconsin courts invalidated this amendment by insisting that compensation can be permitted only if a worker was able to establish an actual wage loss caused by the disability. But workers who were no longer on a company's pay roll could not prove actual wage loss and therefore could not collect compensation for their disability.

In 1935 two more amendments were made to the workmen's compensation law. The first safeguards the right of an employee to file a claim for damages at the time he becomes disabled, even though an earlier claim may have been dismissed because his disability could not be proved at that time. The second stipulates that workers with a non-disabling stage of silicosis who have nevertheless been barred from their regular occupations because of medical examinations, may be awarded compensation by the Industrial Commission up to 70 per cent of their annual earnings for the purpose of training themselves for other jobs. As yet the court has not passed upon these amendments.

Claims and payments

The industrial commission is now engaged in studying the state's experience with silicosis claims. The number of claims grew from one in 1920 to 62 in 1932. In 1933 the number rose sharply to 167 and in 1934 to 298. Examination of the claims filed during these two latter years disclosed that a number of unemployed workers had applied for compensation in the hope that they would receive some monetary award, and also that many workers discharged or refused employment after medical examination promptly filed claims with the industrial commission.

The average compensation per case of silicosis was high. Over a period of fifteen years the average payment per case was $3,430. In 1927, it was as high as $7,000. The

average compensation per case of accidental injury was only $217 over the 15-year period, and thus a single silicosis case was equivalent to about sixteen cases of accidental injury in terms of compensation.

These high costs and the fact that the last employer is liable for the entire amount of compensation are largely responsible for much of the concern employers and insurance companies feel about compensation for silicosis. Employers are often held liable for the payment of full compensation, although the disabled workers may have been employed only a short period of time, in comparison with the length of time normally required for the disease to reach a disabling stage.

Variations in handling cases

Wisconsin industries have shown different methods of handling cases of silicosis and paying compensation for diseased workers. One of the self-insured iron-mining companies gave all of its men a medical examination. Where advanced stages of silicosis were found, cash settlements were made with the workers. When silicosis was found in incipient and less advanced stages, minor settlements were made, even though no disability was present. This particular company made payment in about 100 cases, in many instances without waiting for claims against it to be filed with the industrial commission.

Employment continued

In contrast with the general practice of discharging men wholesale whenever any trace of silicosis was indicated by medical examination, a large self-insured foundry followed a procedure both more humane and much less costly. All of its employees were examined and those with silicosis but with no disability were shifted to other occupations. In the one case of advanced silicosis, compensation was paid and the services of the employee were terminated. Whereas other concerns in the industry were deluged by claim for silicosis as a result of their wholesale discharge policy, this establishment kept its experienced men, and profited both from better efficiency and better morale among the workers.

Estimating Earth Pressures

by N. M. NEWMARK
Research Assistant Professor of Civil Engineering,
University of Illinois

Simple chart speeds up the computation of vertical earth pressures caused by foundation loadings

SUPERIMPOSING the plan view of a loaded foundation on a grid which represents the ground surface and then counting the rectangles within the foundation is a simple and rapid method of determining vertical earth pressures beneath a surface load. The grid or chart (Fig. 1) is the essential feature of the method. This chart is most conveniently thought of as a ground surface plan divided into elemental areas by arcs of concentric circles and radial lines. Its use hinges on the fact that each of these elemental areas, when loaded, contributes a fixed part of the intensity of load on that area to the vertical pressure at some definite depth below the center of the concentric circles.

Theory of chart

This "ground plan" chart is really a graphical representation of an equation for the vertical pressure p_z at depth z below the center of a circular area of radius r subjected to a uniform load p. This equation

$$\frac{p_z}{p} = 1 - \left[\frac{1}{1 + \left(\frac{r}{z}\right)^2}\right]^{3/2}$$

applies only to a surface loading on an elastic, homogeneous, isotropic material bounded by a plane, and is obtained by integrating Boussinesq's formula for pressure due to a concentrated vertical force.

Constructing chart

Values of $\frac{r}{z}$ corresponding to given values of $\frac{p_z}{p}$ (see table) are used to construct a chart (Fig. 1) consisting of concentric circles with centers at A (only one quadrant shown) divided into equal sectors by radial lines. Representing the depth z by a line at the right of the chart, and plotting distances as ratios permits the use of the chart with either English or metric units. The chart is really a polar diagram and thus possesses an origin but no axes. Each radial line and each circle, however, is numbered. The number on a radial line indicates what proportion the circular sector bounded by that line and by the radial line marked zero is of a complete circle. The number on a circle, for example the one marked 0.8, indicates that the vertical pressure at depth z below A is 0.8 x intensity of the load applied uniformly to that complete circle.

A ring such as the one between circles marked 0.8 and 0.7 would cause a vertical pressure at depth z below A of $0.8 - 0.7 = 0.1$ x intensity of load. A curvilinear rectangle, formed by 50 equally-spaced radial lines cutting a complete ring, would cause 1/50 of the vertical pressure that the loaded ring did. Each loaded rectangle, therefore, causes a vertical pressure of 1/50 x 0.1 = 0.002 x load intensity. It is both convenient and easy to construct the chart so that one uniformly loaded curvilinear rectangle causes the same vertical pressure at depth z below A as any other, irrespective of the rectangle's size.

Solving a problem

The first step in using the chart to solve a problem is to draw a plan of the foundation. The scale of this plan depends on the depth at which the vertical pressure is desired. If, for example, the pressure is desired at a point 50 ft. below the ground surface, the foundation should be drawn to such a scale that the line "scale of horizontal distance" on the chart = 50 ft. With a 40x100 ft.

VALUES OF RELATIVE RADIUS OF CIRCLE $\frac{r}{z}$ FOR GIVEN VALUES OF $\frac{pz}{p}$

$\frac{pz}{p}$	$\frac{r}{z}$	$\frac{pz}{p}$	$\frac{r}{z}$
0	0	0.68	1.0665
0.02	0.1164	0.70	1.1097
0.04	0.1661	.....	.....
0.06	0.2052	0.72	1.1561
0.08	0.2391	0.74	1.2062
0.10	0.2698	0.76	1.2607
.....	0.3252	0.78	1.3206
0.12	0.2983	0.80	1.3871
0.14	0.3252	.....	.....
0.16	0.3511	0.82	1.4618
0.18	0.3761	0.84	1.5469
0.20	0.4005	0.86	1.6459
.....	.....	0.88	1.7636
0.22	0.4244	0.90	1.9083
0.24	0.4481	0.91	1.9948
0.26	0.4715	0.92	2.0943
0.28	0.4948	0.93	2.2108
0.30	0.5181	0.94	2.3505
.....	.....	0.95	2.5235
0.32	0.5415	0.96	2.7477
0.34	0.5650	0.97	3.0590
0.36	0.5887	.....	.....
0.38	0.6126	0.972	3.1377
0.40	0.6370	0.974	3.2240
0.42	0.6617	0.976	3.3194
0.44	0.6869	0.978	3.4259
0.46	0.7127	0.980	3.5457
0.48	0.7392	.....	.....
0.50	0.7664	0.982	3.6823
.....	.....	0.984	3.8404
0.52	0.7945	0.986	4.0268
0.54	0.8235	0.988	4.2519
0.56	0.8536	0.990	4.5326
0.58	0.8849	.....	.....
0.60	0.9176	0.992	4.8990
.....	.....	0.994	5.4116
0.62	0.9519	0.996	6.2197
0.64	0.9880	0.998	7.8738
0.66	1.0261	1.0	Infinite

rectangular foundation and the line "scale of horizontal distance" = 2.5 inches, the foundation plan would then be drawn as a 2x5 in. rectangle for $z = 50$ ft. and as a 4x10 in. rectangle for $z = 25$ ft.

The foundation plan drawn on transparent paper is then laid on the chart so that the point under which the pressure is desired coincides with A. It is not necessary that the plan be laid on the chart parallel to any boundaries, for it can be rotated about A as a center. Counting the number of curvilinear rectangles (each has value of 0.002) covered by the superimposed foundation plan and then multiplying this resultant sum of $\frac{P_z}{p}$ by the intensity of the foundation load p gives the vertical pressure at depth z below A. If the vertical pressure is desired underneath a point within the foundation plan the above procedure must be carried out in the four quadrants. A different foundation plan drawing is required for each depth investigated, but one drawing will suffice for all points at the same depth.

Illustrative example

It is required to find the pressure 80 ft. below a certain point when

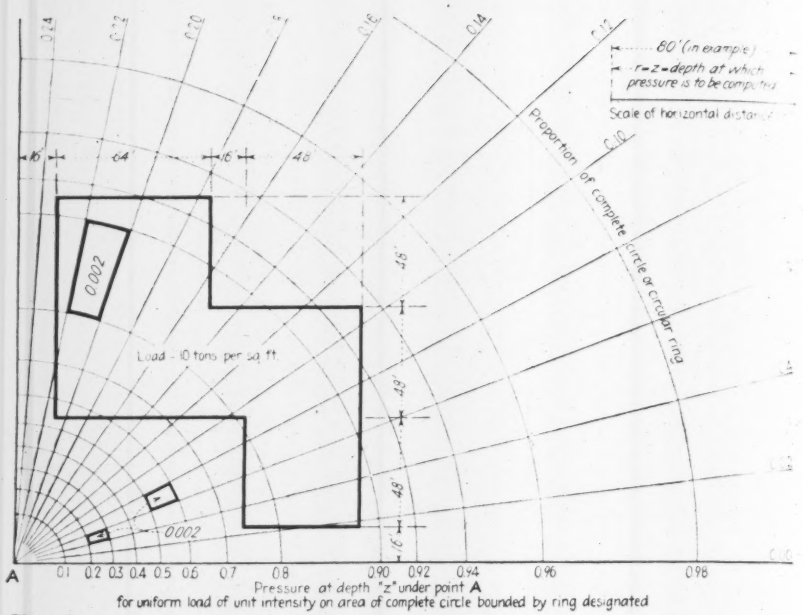
80' (in example)
r = z = depth at which pressure is to be computed
Scale of horizontal distance
Proportion of complete circle or circular ring
0.002
Load = 10 tons per sq. ft.
A
Pressure at depth "z" under point A
for uniform load of unit intensity on area of complete circle bounded by ring designated

Fig. 1. Superimposing a plan view of the foundation on a chart and then counting the rectangles covered is a simple rapid method of estimating veritcal earth pressures underneath the foundation.

the zee-shaped foundation (shown superimposed on Fig. 1) is loaded with 10 tons per sq.ft. In solving, draw the foundation plan on transparent paper to such scale that the line marked "scale of horizontal distance" on chart = 80 ft.—the depth to the point being investigated—and then superimpose the drawing on the chart (Fig. 1) so that the point being investigated coincides with origin A. Since the plan covers 22.5 rectangles, the vertical pressure at the point 80 ft. below A is = 22.5 x 0.002 x 10 tons per sq.ft. = 0.45 tons per sq.ft. An analytical solution of this same problem (for method see Circular No. 24 of Engineering Experiment Station, University of Illinois) gives a vertical pressure of 0.4465 tons per sq.ft.

With the vertical earth pressures estimated at various points below the surface one may then proceed to estimate foundation settlement by a method such as that given in the report of the Special Committee on Earths and Foundations (May, 1933 A.S.C.E. Proceedings, p. 784).

Concluding remarks

Values given in the table can be used to construct the chart to any desired size, and various arrangements of radial lines and circles may be employed. In some cases, a full-circle chart may be more convenient than the one-quadrant type shown.

For actual soils the results obtained by this procedure (or by any other existing procedure) should be used only as a guide to judgment. The use of this simple and rapid method in problems requiring an estimate of vertical pressure will, perhaps, permit more time to be spent on the really important phases of foundation engineering.

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Civil Service Facilities On Contract Basis

SMALL CITIES without facilities to establish and support adequate civil service departments may secure them on a contract basis in California. Los Angeles County, which offered the service as soon as the state act enabling "contracts" among various governmental jurisdictions was passed in 1935, this year, according to the Civil Service Assembly, added two more cities to the list it serves: Maywood, pop. 7,000 and Inglewood, pop. 15,700.

For these cities the Los Angeles County Civil Service Commission has taken over the duties of preparing civil service rules; calling and conducting examinations; providing bulletins announcing the examinations, and in several cases holding hearings on discharge, demotion and suspension of employees.

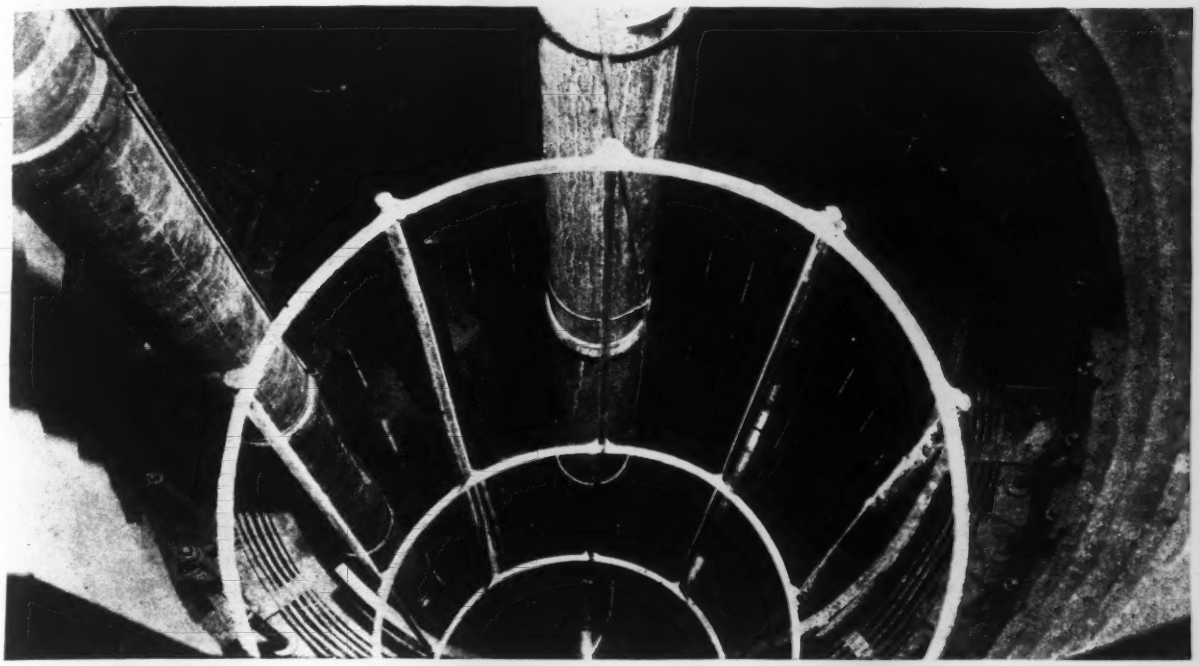

FIG. 1. SHAFT OF THE RADIAL WELL WATER COLLECTOR WITH THE PUMP SUCTION PIPES IN PLACE

Industry Taps an Underground Lake

by C. M. MARATTA
Plant Maintenance Engineer, The Timken Roller Bearing Co., Canton, Ohio

Radial well development of unusual capacity at Timken plant in Ohio draws water from glacial drift formation

WHAT IS BELIEVED to be the largest capacity groundwater collector ever built was recently placed in operation at the Canton, Ohio, plant of The Timken Roller Bearing Co. The collector is of the radial well type, and consists of a shaft, 147.5 ft. deep, from the bottom of which screen pipes have been driven radially in a horizontal plane. The decision to search for an improved and more permanent method for the abstraction of water from gravel and sand beds in the vicinity of the Timken plant was reached when it became evident that the continuation of the method formerly in use was costly and uncertain as to the permanency of the system.

Prior to the construction of the radial well, the Timken plant depended on vertical wells for their water supply. Due to rapid screen incrustation the vertical wells had a relatively short life, making it necessary to drill a new well on an average of every 18 months. These wells, 24 in. in diameter, were sunk in the gravel and sand beds of glacial origin that underlie this section of Ohio. They average 120 ft. in depth and produce about 2,000 gal. per min. each with a drawdown of 7–9 ft. when new.

Highly mineralized water

Due to a large collection area and the porosity of the sand and gravel deposits, water is found in large quantities, and the flow of underground water is very rapid, resulting in a continued high static water level. The water is pure and wholesome but very hard. It has a normal hardness of 365 p.p.m., about equally divided as to temporary and permanent hardness.

The mineral content of the water was the cause of the rapid incrustation of well screens and therefore their short life of from 3 to 8 years. It is generally believed that the incrustation occurs from the liberation of dissolved carbon dioxide as the result of the release of pressure or change of temperature; this loss of carbon dioxide decreases the solvent power of water and causes precipitation of the minerals on the vertical well screens.

The screen openings are reduced by this incrustation and consequently the capacity of the well is reduced until a point is reached where it must be abandoned.

In order to eliminate the expense and effort to maintain the required water supply from individual wells, it was decided to make a radical departure from the orthodox type of well construction and build a well

or water collector in which the screens are at all times under the same water pressure and temperature. By introducing these features combined with a low water velocity through the open screen area, it was believed that incrustation could be substantially eliminated.

Principle of operation

The water collector installed for this purpose was developed in this country by Leo Ranney, of Petrolia, Ont., Canada, as the result of experimental work in connection with the recovery of residual oil from sand and shale. The principles involved were later applied to a new method for the recovery of subsurface waters and the scheme has been used abroad. (*ENR*, Oct. 22, 1936, p. 576). Some patents have been obtained and other patent applications are understood to be pending.

The principle on which the system is based involves the sinking of a shaft of suitable diameter down through the water bearing strata and projecting slotted screen pipes (collectors) radially and horizontally at selected levels into the water bearing formation. Each pipe has its outer end equipped with a special digging point by means of which fine material in its path is removed. Thus it is possible to develop a graded filtering medium surrounding the screen surface of the collector pipes. This digging point also permits the projection of the pipe to a considerable distance and the exposure of a large screen area into the water-bearing strata.

The large area of screen exposed makes it possible to maintain a low velocity flow through the screen openings as well as in the adjacent ground. Consequently, there is only a relatively small drop in pressure between the water in the pipe and that in the nearby ground when withdrawals of water are made. Under these conditions it is believed that no substantial incrustation can take place and the permanency of supply will be assured.

The collector installation made by

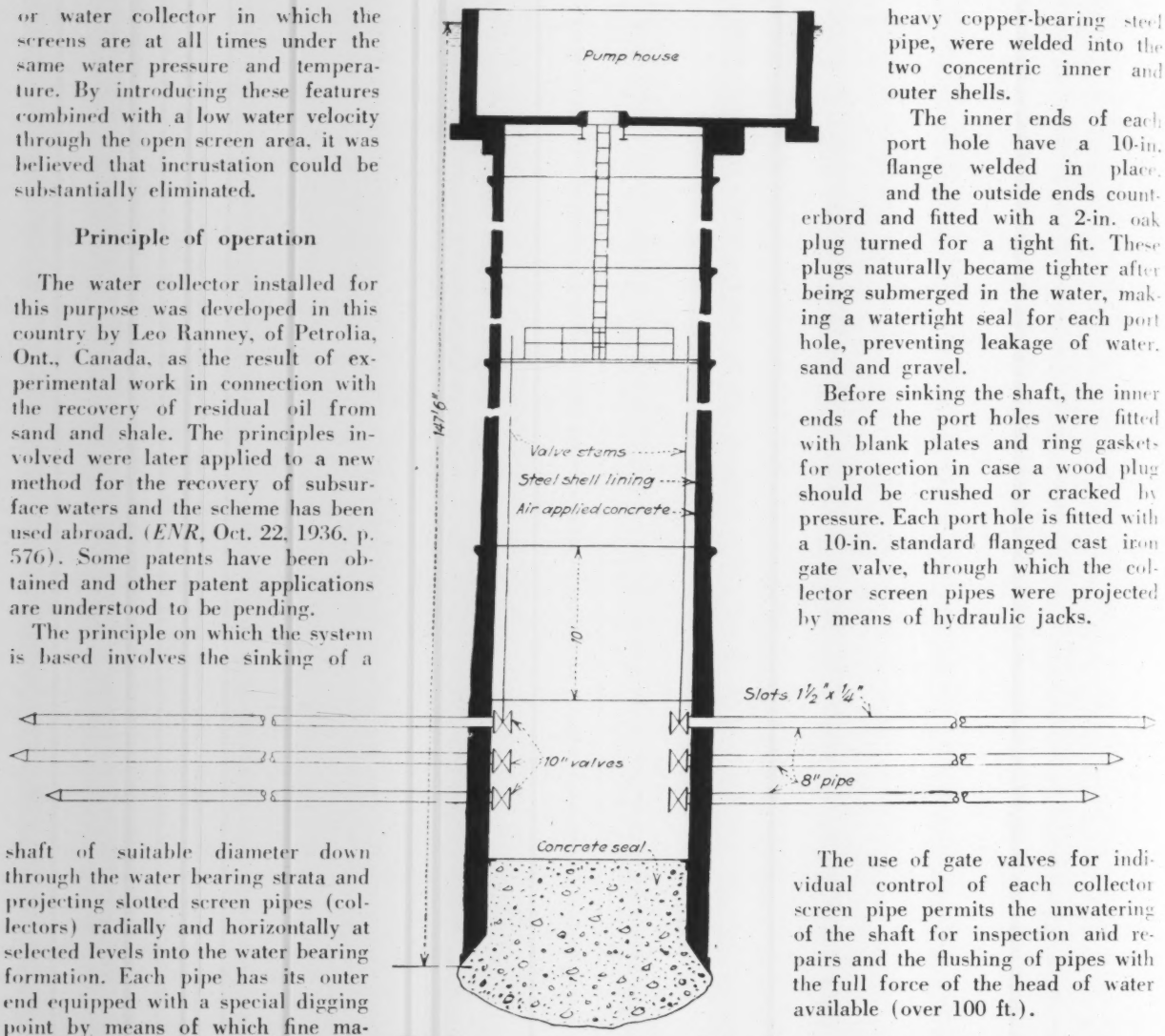

Fig. 2. Cross-section of the well shaft showing the location of collector pipes.

The Timken Roller Bearing Co. has an internal diameter of 12.5 ft. and was sunk to a depth of 147.5 ft. It was constructed of sections each 10 ft. long. The shaft consists of 13 reinforced sections made of air-applied concrete and sheet steel, and a double-wall steel section at the bottom. The latter was made in three sections and comprised the cutting shoe, intermediate and port hole sections. These were all welded together, with the annular space reinforced and filled with concrete.

The port hole section has a total of thirty-six 10-in. port holes through which the slotted screen pipes were driven to a miximum distance of 175 ft. The port holes, made from extra heavy copper-bearing steel pipe, were welded into the two concentric inner and outer shells.

The inner ends of each port hole have a 10-in. flange welded in place, and the outside ends counterbored and fitted with a 2-in. oak plug turned for a tight fit. These plugs naturally became tighter after being submerged in the water, making a watertight seal for each port hole, preventing leakage of water, sand and gravel.

Before sinking the shaft, the inner ends of the port holes were fitted with blank plates and ring gaskets for protection in case a wood plug should be crushed or cracked by pressure. Each port hole is fitted with a 10-in. standard flanged cast iron gate valve, through which the collector screen pipes were projected by means of hydraulic jacks.

The use of gate valves for individual control of each collector screen pipe permits the unwatering of the shaft for inspection and repairs and the flushing of pipes with the full force of the head of water available (over 100 ft.).

Projection of screen pipe

The screen pipes were made from $\frac{3}{8}$ in. copper bearing steel plate punched flat with $1\frac{1}{2}$ by $\frac{1}{4}$ in. slots, then formed into semi-circular sections and welded into pipe having an 8-in. inside diameter. Each screen pipe section was 7.5 ft. in length with beveled ends for welding to each succeeding section.

The first section of each screen pipe to be driven was fitted with a hollow cast steel conical digging-point having slots in the wall. These communicated with a removable inner sand pipe extending from the the digging point back through the screen pipe, packer and jack frame, allowing the fine sand to flow directly into the bottom of the well shaft during the projection of the pipe.

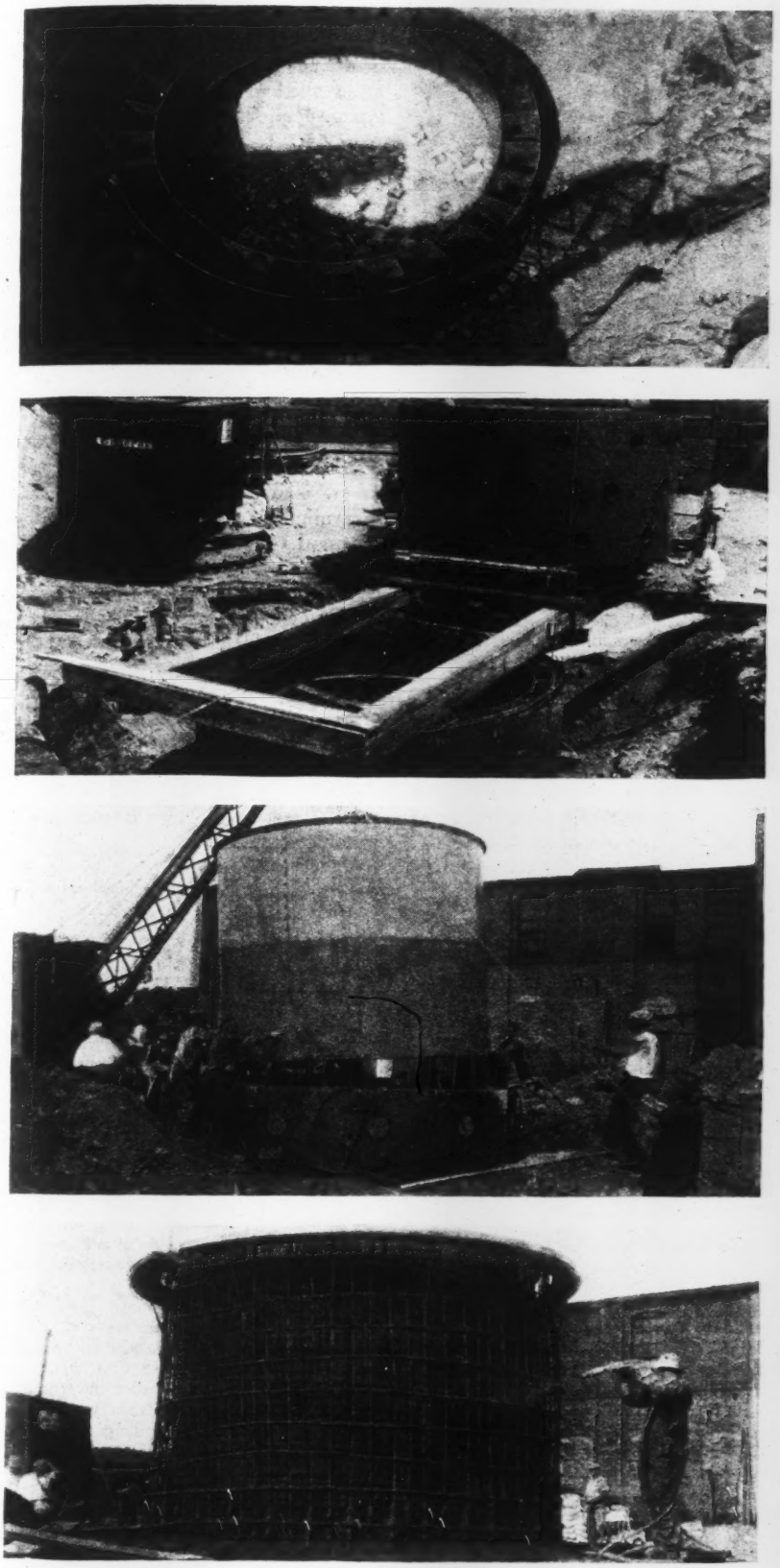

Fig. 3. Shaft construction procedure showing (A) the cutting shoe; (B) the port-hole section; (C) steel liner shell, (D) reinforcement on which the cement lining was applied with an air gun.

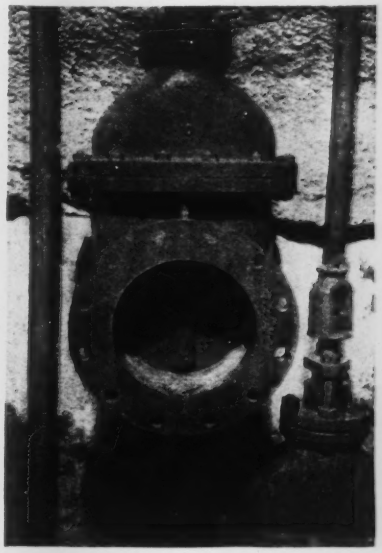

Fig. 4. Port hole valves attached to the collector pipes.

On driving the first section of the screen pipe, the wood plug was forced out of the port hole and pushed aside while the inflow of water in and around the screen pipe was shut off by an arrangement of rubber glands around the outside surface of the screen and a specially constructed sliding hydraulic packer on the inside to withstand the pressure from the 100-ft. head of water and abrasion from sand.

The sand pipe, in addition to removing sand, served as a means for creating a reverse water jet action to loosen the formation ahead of the digging point. The removal of the sand leaves a coarse layer of gravel around the screen pipe, which acts as a natural gravel filter and serves to increase considerably the capacity of the collector pipe. The amount of sand removed averaged 3 cu. ft. per lineal foot of screen pipe projected.

The total length of the 36 screen pipes projected was 2,300 lin. ft., varying in length up to 175 ft. for the longest single length, which was the limit set by property lines. Longer lengths could have been projected where the formation was free of clay deposits and boulders.

Water velocity

The total open area in the screen pipe for the flow of water into the central collector shaft amounts to 1,120 sq. ft. The water velocity through the screen openings when

Fig. 5. Pump house in which are located five motor-driven units and all the port hole valve controls.

pumping 10,000 g.p.m. from the shaft is about 0.019 ft. per second.

Pumping plant

Four deep-well vertical motor driven pumps are now in place in the collector shaft and a fifth pump will be installed. These are located 75 ft. below the surface and have a positive suction head of 46 ft. of water. The combined capacity of the five pumps will be 11,600 g.p.m., against a total head of 130 ft.

The drive motors for the vertical pumps are located in a pumphouse located at ground level at the top of the shaft, as shown in Fig. 5.

Operating results

The average draw-down of water in the shaft is 7 ft. when pumping 7,500 g.p.m. as at the present time. The gate valves on the port holes can be opened or closed as desired by means of valve stems extending from the valves up to a platform 25 ft. below the top of the collector shaft. Each valve stem, weighing 300 lb., is supported on a tapered roller thrust bearing, relieving the valve of all weight and resulting in very easy operation of the valves even though they are 136 ft. below the surface.

The large water capacity of this installation was realized when the valves were first opened after completion of construction. Before four of the 36 valves were opened, the shaft had filled with water up to the static level of the ground. This occurred in a time interval of 4½ minutes or at an average rate of flow of 22,000 g.p.m. against an increasing head of from zero to normal static level, or 103 ft. of water above the lowest row of screens.

Possible output

Assuming a continued static water level as at present, it is estimated that the collector, if required, could produce a flow of 20 million gallons per day. At this rate the velocity through the screens would be about 0.028 ft. per sec. and the draw-down would probably be not more than 15 ft. The ultimate capacity can be determined only at the full draw-down of over 100 ft., this of course exceeds any pumping capacity that can be installed.

The collector system installed was selected principally in order to insure the permanency of the water supply by eliminating screen incrustation. It seems evident that the low velocity of infiltration, the small draw-down, and the efficient flushing facilities should continue to permit the abstraction of large quantities of water economically.

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Some Homely Advice On Plant Maintenance

THE following bit of homespun philosophy, appearing in the November issue of the *North Dakota Water and Sewage Works Conference Bulletin*, expresses some thoughts on plant maintenance that are well worth repeating. Under the title "The Widow's Children" we read:

Elbow grease enthusiasm is probably about as vague a phrase as many that are found in most cross-word puzzle columns. Editorially, let us consider it as physical effort combined with practical ingenuity.

At any rate, it is the sort of activity that tightens the bolts on the washing machine before it falls apart; the urge that causes the ashes to be removed from the furnace before the grate burns out; the impelling force behind a garden-weeding spree designed to keep the ragweed count below the spinach count. Briefly it means doing those necessary and pertinent things which can be accomplished by the application of elbow grease without a heavy touch on the pocketbook.

In the operation of waterworks and sewerage systems there are many instances where a little ingenuity and a little more elbow grease will go a long way toward providing the most in public health protection with what we have.

An open casing, a leaky manhole, a cracked pumphouse floor, unscreened vents or open overflows, direct filter to waste connections, leaky pumps, piping in channels below floor levels—these and numerous other defects can be remedied, principally by the will to do.

Municipal purses are, more often than not, like the widow's purse—well worn and not too well filled. Money for a completely new installation or new equipment is not always available; but enough money is generally available to do the mending jobs that will help keep the system safe.

A bit of the widow's resourcefulness combined with a little well directed physical energy will keep our waterworks and sewage works as trim as the widow's children.

"Not all their clothes were new ones—but they were always clean and neatly mended."

FIG. 1. PLACING ASPHALTIC CONCRETE WEARING COURSE AND SHEET ASPHALT SEAL COAT

Salt Lake Solves Airport Problem

Joining hands with WPA and Salt Lake County, Salt Lake City has brought its airport up to federal requirements for a first-class terminal

COOPERATION of the federal government, the county and city has made possible the financing of airport facilities in Salt Lake City adequate to meet the requirements of the new 40-passenger airplanes which will go into service within a few months. Salt Lake officials in consequence feel a justifiable pride in being able to maintain an adequate field at the junction of five federal airways on the main transcontinental airline route. Recent completion of the paving of three-mile long runways, the equivalent of 25 miles of standard width highway paving, and revamping the 4-yr.-old administration building now makes this third most important air-mail center a bright spot on the aviation enthusiast's map. The method of financing and the construction procedure involving WPA, contractors and city forces merit attention.

The airport is located on comparatively flat, low swampy land partly within city limits, 3½ miles west of Main St. North Temple St. is the south boundary for the 823-acre tract on which were placed the original improvements consisting of a small concrete apron in front of a concrete administration building and hangars with gravel runways. The new work comprises runway pavements, 150 ft. wide and 5,600 ft. long; the pavement is of asphaltic concrete on a diagonal runway and on an east-west runway, and of concrete on a north-south runway. A greatly enlarged apron of concrete in included. Preliminary work consisted of leveling and draining the field, grading the runways and shoulders and rolling the gravel bases. Concrete was batched at a plant on a nearby railroad siding and mixed enroute in truckmixers. The bituminous materials were prepared at a specially set up plant in Parley's Canyon, 12½ miles distant.

Finance and procedure

The Salt Lake airport improvement is a WPA project with the city and county acting as sponsors, each furnishing $75,000 in cash which was turned over to the WPA officials before work was started. The city agreed to furnish $70,000 in addition for plans and specifications, engineering work, supervision, inspection, testing of materials and the furnishing and loading of 150,000 cu.yd. of gravel for drainage and base under runways. Federal funds of $852,000 were allotted, making a total of $1,072,000.

In setting up the project the city commission made an agreement with the WPA officials whereby all engineering work, supervision and handling of construction was to be done under the direction and supervision of the city engineer. Plans prepared in the office of the latter were approved by the WPA chief engineer before work started. Purchase of materials and letting of contracts was done through the U. S. procurement officer who maintained a separate organization from WPA. The regular city engineering department handled all engineering and inspection and material testing. A general superintendent, foremen, head finishers and form setters were employed by the city engineer. WPA employed all other labor, kept the time, handled payrolls and cost accounting, ordered materials through

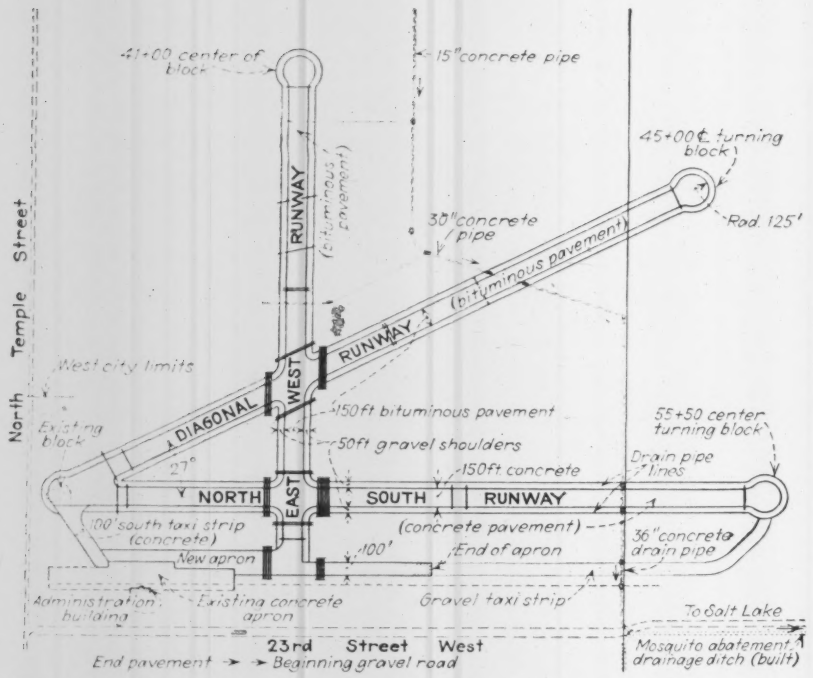

Fig. 2. Layout of Salt Lake City's enlarged airport showing types and size of runways.

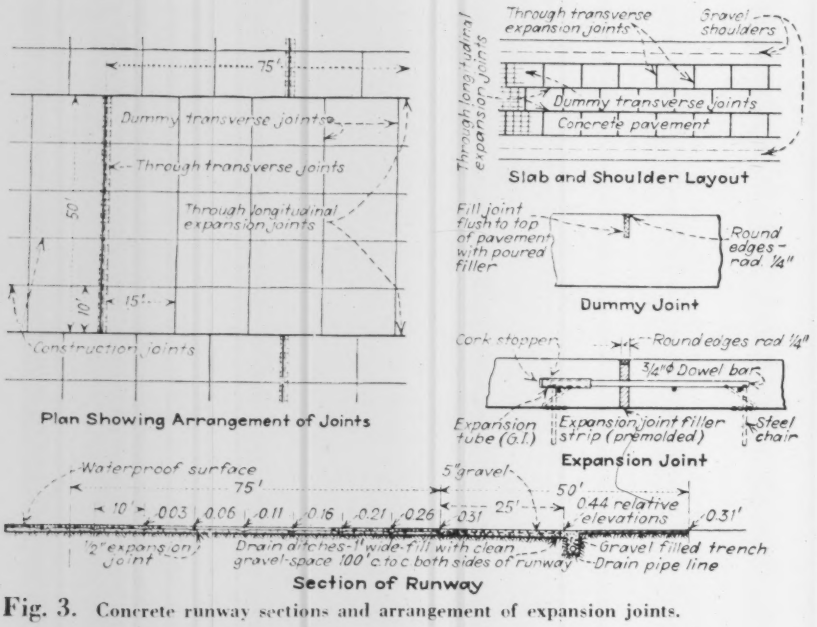

Fig. 3. Concrete runway sections and arrangement of expansion joints.

the procurement officer under the city engineer's specifications and made payments on estimates or certification of the city engineer.

Separate contracts were let for bituminous material, for placing it, for mixed concrete (placing was done by WPA forces), for application of the curing medium, for grading and rolling runways and the gravel in the sub-base, for field lighting equipment and materials (installed by WPA), and for the materials and equipment for the administration building additions.

Drainage

The drainage system consists of a main stem extending northeasterly from the west side of the field to a ditch on the east side. It is a bell-and-spigot concrete pipe varying from 15 in. at the west end to 30 in. at the east or discharge end. It is laid with open joints and surrounded by gravel. The trenches are backfilled to the ground surface with gravel. A vitrified tile drain is provided on each side of each runway and under the apron. These drains are also laid in gravel. The system is designed to care for a rainfall of $\frac{1}{4}$ in. in 30 min. Inlets are about 200 ft. apart.

Shoulders along the runways are covered with 5 in. of gravel and pavements are laid on 6- to 8-in. gravel subbases, rolled in 3-in. layers. Of the 150,000 cu.yd. of gravel furnished, 35,000 cu.yd. was for drainage and the balance for base.

Pavements

The bituminous pavements were laid with $4\frac{1}{2}$-in. black base, $1\frac{3}{4}$-in. asphaltic concrete wearing course and $\frac{1}{4}$-in. seal coat of sheet asphalt. Asphaltic cement percentages in the three courses were $4\frac{1}{2}$, $5\frac{1}{2}$ and $12\frac{1}{2}$ per cent respectively. An existing asphalt plant with 1,500-lb. mixer at the mouth of Parley's Canyon, $12\frac{1}{2}$ miles from the airport, was augmented in capacity by a 4,000-lb. mixer. An ordinary day's run produced 1,200 tons. The base and wearing courses were placed with a spreading machine and rolled as in street work. Quantities involved are 39,500 tons of base, 15,000 tons of wearing course and 2,500 tons of seal coat.

Concrete for the north-south runway and apron was proportioned at a 2-yd. automatic batching plant erected $\frac{1}{4}$ mile south of the south boundary of the airport along a railroad siding. Bulk cement was pumped by a cement pump of 60-bbl. capacity per hour directly from cars to the top of an octagonal bin over the batching hopper to which aggregate was brought by belt conveyor from 25-yd. bins loaded with a 1-yd. clamshell. All gates and operations were air controlled from the operating room under the cement bin. Three 4-yd. truckmixers were equipped with a locked time-control device or batch meter to insure 48 turns of the drum, requiring 4 min. time. For the nearby sections the trip often was completed prior to the full mixing, but the device prevented dumping until the full 48 turns had been completed. From 250 to 300 yd. of

concrete per day was turned out, giving 1,500 ft. of 10-ft. slab. The size of the batch was designed for a yield of 3 yd.; materials used were: cement, 1,833 lb., sand, 4,067 lb., fine gravel, 2,321 lb., coarse gravel, 3,482 lb. and water, 99½ gal.

For 150-ft. runways, fifteen 10-ft. slabs were laid with expansion joints every 75 ft. and dummy joints every 15 ft. The 10-ft. width made it convenient to use ordinary road equipment. Transverse joints consisted of asphalt-impregnated felt, 1 in. thick. Longitudinal joints were ½-in. felt. A clear curing compound was used on the top and black on the sides. The clear compound has a pink coloring (phenolphthalein indicator) to help inspectors determine the extent and uniformity of coverage. Application of this curing agent was a separate contract at 5c. per sq.yd. for black and 5½c. for clear. The rate of application was 1 gal. per 25 sq.yd. for the clear and 1 gal. per 18 sq.yd. for the black. After 11 days permission was given to drive on the slabs with the truckmixers to fill forms for an adjacent slab. Some 25,000 cu.yd. of concrete was required.

Administration Building

Increase in passenger traffic from 34 per day in 1932 to 180 in 1936, all handled in four hours, made essential an enlargement of the administration building, built four years ago, to care for patrons and employees during layover periods. Because of the heavy mail service the postoffice department has need for larger quarters and a wing completely separated from baggage, express and trucking operations has been constructed to postoffice specifications. A special register room, shower, locker room and well lighted space for working on the mail has been provided.

Two new services have been added. Being a junction point, sleeping quarters are required for short stopovers. An existing dispatch room on the third floor has been superseded by a control tower designed to meet the newly proposed specifications of the U. S. Department of Commerce. It is located at the topmost part of the building. Air conditioning has been provided for all parts of the building.

All engineering and supervision of construction have been done under the direction of W. D. Beers, city engineer. A. B. Larson, assistant city engineer, was directly in charge in the field. Louis Hansen was superintendent of construction. The WPA operations were in charge of H. C. Jensen, state chief engineer, and Kenneth Borg, director, WPA District 2, Salt Lake City. M. R. Gardner was WPA supervisor on the job.

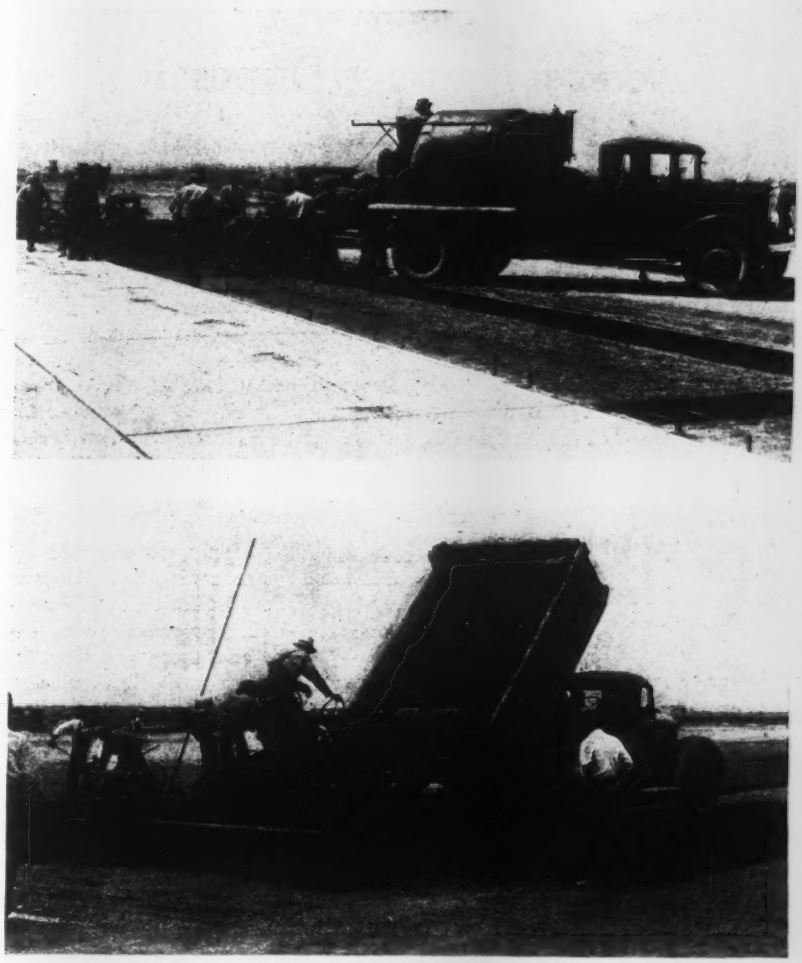

Fig. 4. Concrete was delivered in truck-mixers and discharged in front of the finishing machines. Asphalt came to the spreaders on trucks from a plant set up 12 miles from the airport.

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WPA Sewage Projects in New Jersey

EIGHTEEN SEWAGE disposal plants are being constructed and modernized in New Jersey municipalities at a cost of $959,100, of which $712,687 is in federal funds, according to William H. J. Ely, state WPA administrator.

The most extensive project is at New Milford where a new sewer system and disposal plant, costing $266,102, has been completed. Improvements at the Trenton disposal plant include additions to the screening house, storage building and garage and the conversion of a large section of the area into a park. This work was completed under five projects at a cost of $52,496.

New disposal plants have been completed also at Palisade Park, Bridgeton and Beetlewood, at a cost of $75,111. Repairs or additions have been completed on disposal plants and sewers at Fairview, Pleasantville, Beverly, Riverside and Hatfield.

Notes on Sewage Disposal

A monthly summary of current developments conducted by Willem Rudolfs

HEAT LOSSES—It is well known that ordinary sludge digestion tanks, whether enclosed by an embankment or not, lose considerable heat. There are, however, few records available to show the extent of the heat losses. Walraven (*Report* Ohio Sewage Conf., 1937) reports that during the winter (November-February) only 56.5 per cent of the heat applied was usefully employed. This again indicates the need for designing digestors for heat conservation, especially when the gas is used for power or auxiliary uses around the plant in addition to the heating of the sludge.

Heat loss is related to digestion tank temperature and design of heating coils. Since the amount of heat transferred per sq.ft. of coil surface is dependent in part upon the temperature differential between the circulating water and the sludge, economical coil design calls for relatively low digestion temperature and high water temperatures. To prevent coil incrustations the incoming water is usually kept at about 150 deg. F.

GRASS FILTER—The use of sand and magnitite filters to further clarify the effluent from sedimentation units has been making rapid strides during the last few years. The old and nearly forgotten method of running settled or partially settled sewage on grass plots may be used for a similar purpose under certain conditions. Fretter (*Report* Ohio Sewage Conf., 1937) reports that at Medina, O., excavations for sand filters were made, but delay in construction caused a heavy growth of grass to appear on the floor of the excavation. With the thought of obtaining some additional sedimentation the plant effluent was diverted through the incomplete sand filter bed; the result was a marked improvement in the quality of the effluent. The consulting engineer thereupon included this device as an adjunct to the plant. It appears that certain types of grasses or weeds are more effective than others for purification. The practice is sound, because each blade of grass or stem of weed acts as a colloider resulting in reduction of suspended solids in the effluent.

PHENOL REMOVAL—The removal of traces of phenols from water by activated carbon is well known. Phenols from distillation or low temperature coking processes, from gas house waste and those produced in connection with carbonization and hydrogenation of liquors can apparently be absorbed by activated carbons to the extent of 99.5 per cent. Rutovskii and Antropova (*Jour.* Chem. Indus. Moscow 12, 940-7) passed phenol waste waters over peat charcoal at 40 deg. C. For recovery, the phenol is distilled directly onto the carbon in amounts equal to 30 per cent of the water used. The carbon is regenerated by passing steam over it at 170-180 deg. C. for 1 to 1.5 hr.

In another process given by Chulkov (*Jour.* Chem. Indus. Moscow, 10, 48-59) a phenol solution is treated with sodium hydroxide or calcium hydroxide, and chlorine gas is passed through it. A resin is yielded. Air is passed through the solution to remove excess chlorine and the liquid thereafter treated with activated carbon. A colorless, odorless, phenol-free liquid is said to be obtained. The process can be applied (with minor modifications) to coal gas and tar products. The resin may be used in lacquers or paints for synthetic resin.

SEWAGE OXIDATION—The activated sludge process of sewage treatment, usually considered as essentially a biological process, purifies sewage at rates which exceed very greatly those observed in ordinary biochemical oxidation. The true mechanism of purification of sewage by the activated process is not known, although many large plants have been built which produce excellent results. During the last few years a number of theories have been advanced to account for the phenomena observed and experimental work has been conducted which ultimately will lead to the proper conception of this complicated process.

Butterfield (*Jour.* Bacteriology, 34, 207, 1937) isolated bacterial organisms in pure culture from activated sludge and using them as "activated sludges" found that they produced a high rate of oxidation of the pollutional material in sewages. The flocs formed were able to oxidize about 50 per cent of the 5-day biochemical oxygen demand in a 5-hr. period and about 80 per cent in a 21 hr. interval. Nitrogenous materials were not oxidized because these bacteria were not capable of such action.

SLUDGE WITHDRAWAL—It is common experience of plant operators that at the beginning of sludge withdrawal from digestors the sludge has a considerably higher concentration than after removal has proceeded for a short while. O'Brien (*Report*, Ohio Sewage Conf., 1937) discovered that if an attempt was made to draw sludge with the stirring mechanism idle, only the bottom sludge around the center of the tank was removed and thinner sludge broke through from the overlying layers. By running the stirring mechanism continuously, sludge was thicker, assisting greatly in drawing sludge rather than thin liquor on the drying beds.

PEAT MOSS INSULATION—To prevent heat losses from digestors a number of different insulation and protection materials are used. They vary from simply piling earth against concrete walls to the use of hollow tile and provisions for fillers such as ashes, slag, asbestos fiber, glass wool and coarse sand. Bleckman (*Die Stadtereinigung*, 28, 218, 1937) describes the insulation of digestion tanks with peat moss which is placed in layers in an air space formed with concrete blocks. Peat moss is said to be cheap, durable and effective. Its insulating value has long been recognized in northern countries where frost only penetrates a few inches below the surface of the peat beds during severe winters.

THE WEEK'S EVENTS

(Continued from page 7)

Patent Infringement Charged to PWA

Suit before Court of Claims alleges infringement of patent on slab ceiling

A charge has been made in a suit brought in the Court of Claims that in the construction of Williamsburg houses, PWA housing project in Brooklyn, N. Y., patents on a "smooth-ceilings" system of construction held by Walter H. Wheeler were infringed by the PWA. Mr. Wheeler has filed a claim for $71,000 against the government.

Mr. Wheeler claims that he spent much time in discussing his system with the Housing Division of PWA, that he supplied the division with details and calculations, and that the housing division advised him that his system was not suitable for the types of building they were constructing.

Mr. Wheeler asserts the design of the Williamsburg project used an infringement of his system and that although he made repeated protests the housing division continued with the construction of this project and has refused to pay him for the use of his system. He has therefore filed a claim against the government for $71,000, which he claims is the amount saved by the government by using his system in the design of these buildings.

In response to a request from an *Engineering News-Record* representative, the U. S. Housing Authority and the Department of Justice authorized the publication of the following brief statement of their position in the infringement case:

The design for Williamsburg houses was prepared under contract by a group of architects recommended by the New York City Housing Authority. Engineering features were designed by an eminent structural engineer for the architectural group. The government, in the construction of housing projects, has never utilized any of the designs of Mr. Wheeler submitted by him in an endeavor to interest the government in this type of flat-slab construction generally for all housing projects. These proposals were all definitely rejected. In the Williamsburg housing project the design for the buildings was prepared by architects not in the government service. Whether or not there is a conflict between the design used and that for which letters patent were issued to Walter H. Wheeler is now the matter of litigation which is pending before the Court of Claims.

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First Allegheny Dam Bids Are Opened

Fourteen bids were opened December 17 for the construction of the Crooked Creek reservoir dam, first structure in a Pittsburgh flood control project which will eventually include nine dams and reservoirs costing about $80,000,000. Low bidder on the project was George M. Brewster & Sons, Inc., of Bogota, N. J., which bid $2,368,000. The Dravo Corp. was second, with a bid of $2,537,000, and the Central Pennsylvania Quarry Stripping & Construction Co. of Hazelton, was third with $2,542,000.

The government estimate on the project was $3,006,000; this was based on construction by force account.

Bids were opened on the following day for a second dam in the Allegheny project, Tionesta Dam. S. J. Groves & Sons Co. of Minneapolis were low with a bid of $2,625,000. The Minder Construction Co. of Chicago with $2,638,000, and Dravo Corp. of Pittsburgh came third with $2,748,000.

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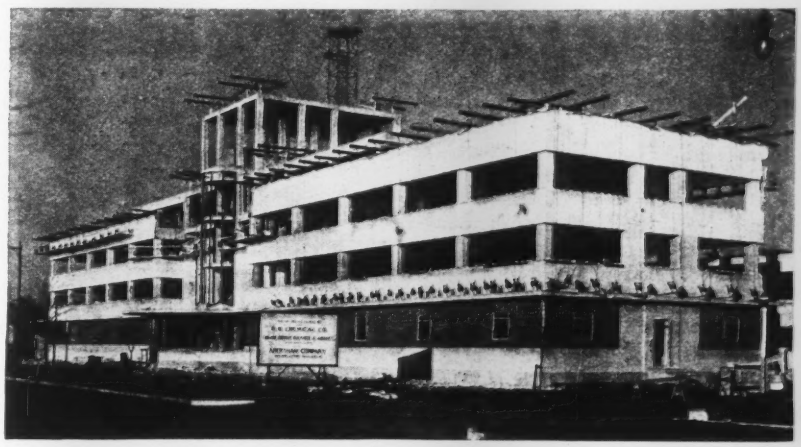
California Storm Damage Reaches Large Total

Damage to California structures sustained in the storm and high water of December 10-12 will run into several million dollars. On the state highway system, the division of highways estimates the total cost of repairing damage at $1,500,000 which includes temporary bypasses for many old bridges wrecked or damaged and extensive washouts in many parts of the system. It is notable that major bridges of recent design withstood the floods extremely well. Particularly heavy damage occurred on the Feather River Route opened to traffic last year.

The Southern Pacific R. R. estimates the cost of repairing storm damage at $152,000; the Northwestern Pacific placed its loss between San Francisco and Eureka at $84,000; the Pacific Gas and Electric Co., with ten power houses flooded, about as many transmission line failures, and heavy incidental losses, estimates losses at $260,000.



NEW FACTORY BUILDINGS IN CAMBRIDGE

THE NEW PLANT of the B. & B. Chemical Co., of Cambridge, Mass., located on a parkway facing the Charles River, will be completed about March 15. The front building, four stories high, is 280 ft. by 52 ft. in plan and 53 ft. high; it will house offices, laboratories, a shoe machinery room, and a tannery. First floor lighting is by glass block, and the windows of the upper floors are to be flushed with the brick facing, the reinforced concrete columns being set back to permit the glass to be carried past.

Structural columns are of uniform cross section throughout their length, with the amount of reinforcing diminished in the upper stories. The floor slabs are of flat grid construction.

Coolidge, Sheply, Bulfinch & Abbott are the architects on the building, and the Aberthaw Co. are construction managers. Both are Boston firms.

Condemnation Permitted For Jefferson Memorial

Obstacles to the start of construction on the proposed $30,000,000 Jefferson National expansion memorial project at St. Louis, Mo., were set aside December 20 when the U. S. District Court sustained the motion by government attorneys to strike out objections that have been raised to condemnation suits brought by the government to take title to land used for the project.

The court leader appointed three commissioners to value property to be taken over for the project. The basis of valuation will be the price that a willing buyer would pay a willing seller for each parcel appraised; the use intended is not to be taken into consideration, the court advised the commissioner.

Six contentions brought

Six contentions were brought by property owners in attacking the condemnation proceedings; all were stricken out by the court. They were: the historic sites act does not authorize condemnation of property. The secretary of the interior exceeded his authority and acted without the sanction of a valid congressional act. The historic sites act is invalid in that it attempts to validate legislative power without proper guides and standards. The use contemplated in the government petition is not a public use within the meaning of the constitution. Congress has not specifically authorized the condemnation of land. Funds are not available as set out in the petition.

In upholding the government, the court said "The Supreme Court and our several U. S. Circuit Courts of Appeal have heretofore unanimously declared the condemnation of land as a historic site for public park purposes or for public use to be within the purview of the fifth amendment to the constitution."

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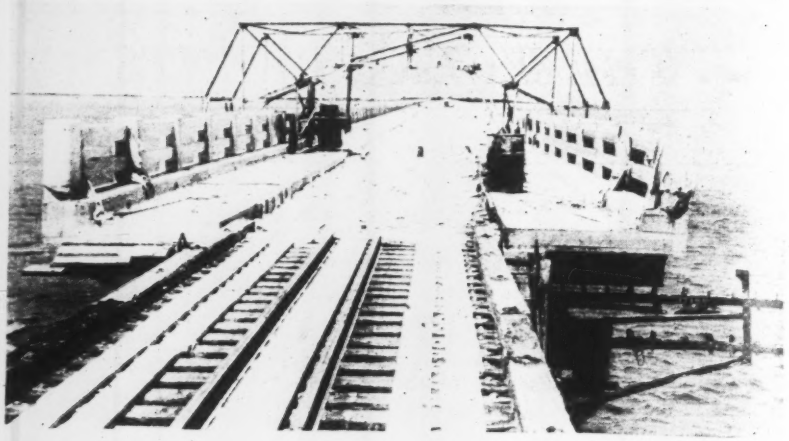
Niagara Industrial Plant Agrees to Stop Pollution

Representatives of the New York State Conservation Department met with heads of industrial plants along the Niagara River in an effort to stop the slaughter of fish which has been occurring over a period of six weeks (*ENR* Dec. 16, 1937, p. 995). Inspector Willard E. Tillman of the State Conservation Department reports that each plant agreed to install its own disposal system and report back to the department within a month.

As the agreement was made, renewed slaughter of fish in the Niagara River, near Buffalo, N. Y. occurred over the week-end of Dec. 18-20. This was the third such outbreak.

Because of the bi-weekly regulatory with which the three killings of fish have occurred, Inspector Tillman has suggested that some large industrial plant is cleaning its vats at two-week intervals. He said that a line of pollution extended 500 ft. into the river from the American shore and that it must have been highly poisonous because it killed fish for miles.



Acme Photo

ROAD TO THE ISLANDS

CHANGES that are being made in the roadway of the old Key West R. R., which is being converted to highway uses, are graphically shown in the above picture. Many miles of the line, as it crosses the Florida keys are on bridges, which are being widened as shown to carry motor vehicle traffic.

The railroad, which was Key West's only connection with the mainland except for ferrys, was abandoned after it was partially destroyed by the hurricane of 1935. Work started this year on the program.

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Concrete Industry to Meet At Chicago in February

The use of concrete in housing construction will hold a central place in the sessions of conventions of four concrete industries which will be held simultaneously at Chicago during the week of Feb. 7-11. Program committees for the American Concrete Contractors Association, National Concrete Masonry Association, National Cinder Concrete Products Association, and the Cast Stone Institute have arranged for papers explaining how the U. S. housing act of 1937 will operate and a number of analyses of the current housing market.

Special attention will be devoted to the increasing use of reinforced concrete house construction in a paper on "Recent Developments in Reinforced Concrete House Construction" and in a paper by Arthur E. Jordan, Midwestern builder, who will tell "What I Learned About Building Reinforced Concrete Houses."

A series of talks and demonstrations has been arranged by the Concrete Contractors Committee on the question of concrete finishes, which will cover the various processes of coloring and applying texture to concrete. Use of ready mixed concrete, concrete vibration, and selling plans will be other subjects which will be discussed at this session.

Revision of fire insurance rates on concrete buildings, the use of reinforcement in concrete masonry, and prefabrication of concrete members are among the subjects which will be discussed by the concrete products group.

A concrete industries exposition is to be held, in connection with the convention, in which manufacturers will exhibit and demonstrate machinery, equipment, and materials used in concrete work.

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Jewett Will Receive Washington Award

The Washington Award, presented each year by the Western Society of Engineers to an engineer for accomplishments which preeminently promote the happiness, comfort and well-being of humanity, goes this year to Dr. Frank B. Jewett, electrical engineer and president of the Bell Telephone Laboratories Inc., for his part in the development of telephony.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

NATIONAL PAVING BRICK ASSOCIATION, annual meeting, Netherland Plaza Hotel, Cincinnati, Jan. 12-14.

AMERICAN ENGINEERING COUNCIL, annual convention, Washington, D. C., Mayflower Hotel, Jan. 13-15.

SECRETARIES OF ENGINEERING ORGANIZATIONS, annual conference, Washington, Mayflower Hotel, Jan. 13-15.

ASSOCIATED EQUIPMENT DISTRIBUTORS, annual meeting, Cleveland, Jan. 15-16.

AMERICAN ROAD BUILDERS ASSOCIATION, road show and convention, Cleveland, Jan. 17-21.

AMERICAN WOOD PRESERVERS ASSOCIATION, annual convention, Congress Hotel, Chicago, Jan. 18-20.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, New York City, Jan. 19-21.

NATIONAL RIVERS AND HARBORS CONGRESS, 33rd convention, Mayflower Hotel, Washington, D. C., Jan. 20-21.

PURDUE ROAD SCHOOL, annual school and road show, Purdue University, Lafayette, Ind., Jan. 24–28.

ENGINEERING INSTITUTE OF CANADA, annual meeting, London, Ont., Jan. 31-Feb. 1.

LIME PUTTY PRODUCTS ASSOCIATION, annual meeting, Netherland Plaza Hotel, Cincinnati, Feb. 1.

AMERICAN CONCRETE CONTRACTORS ASSOCIATION, National Concrete Masonry Association, National Cinder Concrete Products Association, Cast Stone Institute, joint convention, Hotel Sherman and Medinah Athletic Club, Chicago, Feb. 7-11.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, annual convention, Willard Hotel, Washington, Feb. 8-10.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, annual meeting, Engineering Societies Building, New York City, Feb. 14-18.

ASSOCIATION OF HIGHWAY OFFICIALS OF NORTH ATLANTIC STATES, annual convention, Hotel Ambassador, Atlantic City, N. J., Feb. 16–18.

REGIONAL AND LOCAL

ILLINOIS CONTRACTORS ASSOCIATION, annual meeting, Jefferson Hotel, Peoria, Ill., Jan. 11-12.

UNIVERSITY OF COLORADO, Highway Engineering Conference, Boulder, Colo., Jan. 13-14.

NEW JERSEY ASSOCIATION OF PROFESSIONAL ENGINEERS AND LAND SURVEYORS, Elks Club, Jersey City, N. J., Jan. 14-15.

NEW YORK STATE SEWAGE WORKS ASSOCIATION, annual meeting, New York City, Jan. 20-22.

NORTH CAROLINA SOCIETY OF ENGINEERS, annual meeting, Raleigh, Jan. 28-29.

SOUTHWEST ROAD SHOW AND SCHOOL, annual session, Wichita Exhibition Building, Wichita, Kan., Feb. 22-25.

ELECTIONS AND ACTIVITIES

A PLAN to appoint a full time secretary to protect the interests of Arizona engineers was adopted at a recent meeting of the Arizona section of the A.S.C.E. The plan was suggested after a number of speakers, including W. R. Hutchins, president of the chapter, Raymond A. Hill of Los Angeles, and K. H. Talbot had expressed the opinion that unless the societies took such action they would find their membership going into the unions. Clyde Myers was elected president of the section, J. C. Park and Vic H. Householder vice-presidents, and W. R. Hutchins director.

SOME SKEPTICISM as to the effectiveness of action by the societies in enforcing wage scales was expressed at a recent meeting of the Westchester County chapter of the New York State Society of Professional Engineers. Charles A. Van Horn and James B. Diamond, representatives of the International Federation of Technical Engineers, Architects and Draftsmen, A.F.L., addressed the meeting on the question of whether unionism was a means of enforcing wage scales for engineers. In the discussion which followed, A. Richards said that a committee of the A.S.C.E. which had been considering the wage question for ten years was beginning to reach conclusions. Others at the meeting, including Messrs. Ferrend and Benline, said that past action by the American Society of Civil Engineers had achieved no definite results.

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License Examinations

NEW YORK: Examinations for professional engineers at New York, Albany, Syracuse and Buffalo, Feb. 1-3. Examinations for land surveying will be held Feb. 4.

BRIEF NEWS

THE THOMAS A. EDISON medal of the American Institute of Electrical Engineers has been awarded for 1937 to Gano Dunn, president of the J. G. White Engineering Corp. of New York City.

TWELVE TRACTS of Indian land in the West, comprising about 5,000,000 acres of wild country, have been protected against encroachment by an order, issued by Secretary Ickes and John Collier, Commissioner of Indian Affairs, forbidding construction of motor roads in these areas. Largest of the areas affected is the Rainbow Bridge region on the Navajo Reservation in Arizona and Utah.

THREE insolvent towns in Maine have been taken over by the Maine Emergency Municipal Finance Board, and thirteen other towns in Maine have acted to "de-organize" during the past three years, according to reports to the International City Managers Association. The Emergency Finance Board is a state agency which is authorized to take control of any municipality that drops a year and a half behind in the payment of state taxes, defaults on its bond issues, or becomes insolvent for any reason other than disbursements for emergency relief. When the board takes over a municipality it may declare any and all town offices vacant and temporarily fill and supervise them. De-organization, as carried out by the other towns, was undertaken because the cost of continuing the town government was believed excessive. Eight have had their normal functions absorbed by state and county, and the other five abandoned the town form of government in favor of a "plantation," a simplified form. De-organization takes place by local referendum after passage of a special act by the state legislature.

AERIAL BOMBS of from 600 to 1,000 lb. weight can be withstood by the cellars of a new apartment building which is to be constructed in Goteborg, Sweden. The six-story building will be equipped with bomb-proof and gas-proof compartments containing a hospital room, special gas locks, bathing facilities and storerooms. Reinforced concrete will be used on all of the floors, and a roof will be constructed of a heavy thickness of reinforced concrete. All of the rooms of the bomb-proof cellar will be constructed of extra heavy concrete and will include provisions to protect the walls with sandbags.

OBITUARY

JULIUS KAPNER, 40, chief of the survey staff of District 8 of the Pennsylvania state highway department, was killed by an automobile Dec. 19.

JOHN J. DOOLEY, a civil engineer connected with the Degnon Contracting Co. who had also been in the operating department of the Roosevelt International Bridge, died recently in Cornwall, Ont.

BEALE M. SCHMUCKER, county engineer of Camden County, N. J., died Dec. 23 at the age of 49 in Haddon Heights, N. J. Except for war service, he had been with the Camden County engineer's office since 1912, and he had been chief engineer since 1929. Mr. Schmucker was president of the New Jersey Association of Professional Engineers and Land Surveyors and a past president of the New Jersey Association of County Engineers.

ARTHUR C. CORY, a New England building contractor who specialized in the construction of textile plants, died at Acushnet, Mass. Dec. 27, aged 71.

WILLIAM E. HANNON, senior engineer in the Boston street department, died there Dec. 24 at the age of 64. Mr. Hannon first became connected with the city engineering department in 1893. He had engaged in private practice, had been city water commissioner, and had been senior engineer in the street department since 1923.

JOHN J. CURRAN, Boston building contractor, died in Arlington, Mass. Dec. 25 at the age of 64.

FRANK E. COLBY, 80, director of the Sioux City, Iowa, building inspection department since 1918, died recently in that city. A graduate of Iowa State College in 1881, Mr. Colby practiced privately as an architect for several years before joining the city engineering staff in 1917. A year later he took the position which he held until his death.

WILLIS B. HAYES, 69, for 27 years an engineer for the U. S. Treasury Department, died in Wichita, Kan., Dec. 17. Mr. Hayes had been supervising construction of a federal building at Salina; his home was in Crafton, Pa.

WALTER CLERK, assistant engineer to the Montreal Town Planning Commission, died Dec. 22 in that city at the age of 46. Mr. Clerk had been in the city engineering department as highway engineer for the past 20 years.

WALTER A. WOOD, 73, secretary and manager of the Engineers Club of Baltimore for the last 15 years, died in Baltimore Dec. 21.

JOSEPH T. WOODRUFF, city planner and assistant professor of architecture at the Massachusetts Institute of Technology, committed suicide at Longmeadow, Mass., Dec. 18 at the age of 43. Mr. Woodruff had served as engineer for the Springfield, Mass. planning board, the Philadelphia Tri-State District, and the Greater Pennsylvania Council.

CHARLES J. SELVAGE, a contractor who had done much railroad and highway work in Virginia and Kentucky, died Dec. 17 in Richmond, Va., at the age of 64.

WILLIAM SCHAEFFER, 29, an inspector for the U. S. Engineers, died in East St. Louis, Ill. Dec. 15 of burns suffered a month previously when a surveyor's rod he was using brushed against an electric power line.

JOHN A. CARTER, for the past quarter century head of the water department of the city of Malden, Mass., died there Dec. 16 at the age of 78. He had been connected with the department for about 50 years.

HARRY B. O'NEIL, a civil engineer who had practiced at Keene, N. H. for the past 25 years, died at South Acton, Mass. Dec. 5 at the age of 51. Mr. O'Neil was a graduate of Brown University.

HARRY A. NELSON, for the past year PWA engineer on the Sutherland hydroelectric project in Nebraska and previously a member of the engineering firm of Towl, Nelson & Schwartz, died in North Platte, Neb., at the age of 54.

H. BRUCE KIPPEN, 75, for 25 years a drainage engineer with the Canadian National Rys., died in Toronto Dec. 10 at the age of 75. Mr. Kippen was on the engineering staff of the Canadian Pacific Ry. during the period of its construction.

F. W. PEACE, 71, for 20 years city engineer of Porterville, Cal., and city manager there from 1925 to 1931, died Dec. 6. Until recently he was employed in the engineering offices of the California state highway department.

ED MASON RITCHIE, 64, for 11 years deputy county surveyor of San Diego county, Cal., died at Pacific Beach, Cal. Dec. 12. Before taking the county office, he was superintendent of bridges and buildings for the San Diego and Arizona R. R.

PERSONAL

GEORGE N. SCHOONMAKER has been made chief engineer of the Toledo, Ohio, water department. He was formerly service director.

ELLIS A. FRINK, engineer of bridges of the Seaboard Airline Ry. System, who has been in charge of bridges and steel structures for the Seaboard Airline since 1906, retired from active duty the first of the year. Mr. Frink began his experience in the bridge field with the Berlin Iron & Bridge Co. of East Berlin, Conn., being connected with that firm from 1887 to 1898. Then for five years he was an officer and engineer of the Structural Iron & Steel Co. of Baltimore, Md. After a brief period in the contracting business and with the Baltimore & Ohio R. R. and the Virginia Bridge & Iron Co., he joined the Seaboard Airline Ry. as engineer of bridges in 1906, taking over the administration and direction of the bridge engineering department. He has remained in that position until now. Mr. Frink has been a director of the American Railway Engineering Association and was for a number of years chairman of the committee on wooden bridges and trestles. He has served for many years as a member of the consulting bridge committee of the Railroad Presidents Conference Committee on Evaluation.

LESLIE H. HORNSBY, assistant engineer of bridges, Seaboard Airline Ry., has been appointed engineer of bridges, succeeding Mr. Frink. A graduate of McGill University, Mr. Hornsby was connected with the Structural Steel Co. of Montreal, the Grand Trunk & Toronto Terminal R. R., the Hydroelectric Power Commission of Ontario, and the Lackawanna Bridge Co., before he went with the Seaboard Airline Ry. in 1922. His first position with the railroad was as draftsman in the bridge department at Norfolk; he later was appointed bridge designer and then assistant engineer of bridges.

CARL W. MENGEL, formerly engineer for PWA in North Carolina and recently transferred to the regional PWA office at Atlanta, has been appointed director of public works of the city of Greensboro, N. C.

WILLIAM H. FOUSHEE, assistant engineer in the sixth division of the North Carolina State Highway Commission, has been appointed state representative in North Carolina for the asphalt sales department of the Standard Oil Co. of New Jersey. Mr. Foushee had been connected with the highway commission for 17 years.

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

FOR the fourth consecutive month lower lumber prices are the principal change. Southern Pine prices are $1.00 to $9.00 lower in Chicago; $15.00 to $22.50 lower in New Orleans; $1.00 to $2.50 lower in New York; $1.00 lower in Philadelphia; and 50c. lower on 1-in. planks in St. Louis. Native pine is down $3.00 to $5.00 in Denver. Long Leaf Yellow Pine timbers are $2.50 lower in New York; $1.00 in Philadelphia; but $2.00 higher in Baltimore; and $4.00 to $6.00 higher in New Orleans. Douglas Fir is $1.00 to $6.00 off in Chicago; 50c. to $7.90 off in New Orleans; $1.00 to $1.50 off in New York; $1.00 off in Philadelphia; but $1.00 to $4.00 higher in Baltimore.

Cement prices are up 4c. in Baltimore, New Orleans and Pittsburgh due to increased freight rates. Denver cement price is 6c. lower.

Skilled labor in New Orleans which previously ranged from 75c. to $1.00 per hour for carpenters and $1.00 to $1.25 for structural ironworkers, closed up this span with top rates now prevailing. Common labor in New Orleans, formerly ranging from 30c. to 40c., now stands at 40c. per hour. Carpenters in San Francisco are working at $1.25 per hour, under a "stop-gap" agreement. This is 25c. per hour below their former rate. Hoisting engineers rate is up to $1.375 in Los Angeles, a 12½c. per hour increase.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT (Per bbl., carload lots, including 40c per bbl. for bags, cash discount not included)			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE (Ready Mixed 1:2:4, 50 c.y. or more, delivered)
	Cloth Bags*a*	Paper Bags	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	
Atlanta	$2.89	$2.62	$2.54	$1.65	$1.75	$1.55	$1.55	$1.65	$1.55	$1.65	$8.90
Baltimore	2.35	2.10	1.90	1.80‡	1.80‡	1.30‡	1.80‡	1.80‡	1.75‡	1.75‡	7.35
Birmingham	2.44	2.19	1.99	1.80	1.80	1.45	1.00	1.00	.90	1.15	5.45
Boston	2.25*b*	2.00*b*	1.80*b*	1.30	1.30	.90	1.40	1.40	....	....	7.00*m*
Chicago	2.45	2.20	2.05	1.20‡	1.20‡	1.20‡	1.35‡	1.35‡	1.00‡	1.00‡	....
Cincinnati	2.56	2.31	2.05	1.20	1.20	1.30	1.80	1.80	....	....	6.60
Cleveland	2.30	2.05	....	1.40	1.40	1.30	1.60	1.60	1.65	1.65	7.15*i*
Dallas	2.30	2.05	1.85	1.40	1.40	1.05	1.00	1.15	1.84	1.89	7.00
Denver	3.02	2.77	....	1.20	1.40	.90	....	....	....	....	....
Detroit	2.15	1.90	1.65	1.15	1.25	.95	1.50	1.60	1.15‡	1.25‡	6.50
Kansas City	2.55	2.30	2.06	1.85	2.30	1.15	1.85	1.80	....	....	7.90*n*
Los Angeles	2.32	2.12	....	2.00	2.00	1.70	2.00*f*	2.00*f*	....	....	7.60
Minneapolis	2.86	....	2.41	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	7.40*j*
Montreal	....	....	1.70*c*	.95	.85	1.15‡	1.10‡	1.18‡	....	....	6.50*l*
New Orleans	2.41	2.16	2.01	1.50	1.50	1.25	....	....	....	....	7.25
New York	2.45‡	2.20‡	....	1.50*de*	1.50*de*	1.00*de*	1.65*de*	1.75*de*	....	....	7.70
Philadelphia	2.55	2.30	2.10	1.55‡	1.65‡	1.35‡	2.00‡	2.05‡	1.00	1.00	8.25*k*
Pittsburgh	2.44	2.19	1.99	1.80‡	1.80‡	2.10‡	2.25‡	2.25‡	1.50	1.50	8.75
St. Louis	2.52	2.37	....	1.50‡	1.50‡	1.50‡	.85*h*	.85*h*	.85*g*	.75*g*	7.50
San Francisco	2.72	2.52	2.20	1.35	1.35	1.35	1.50	1.50	....	....	7.50
Seattle	3.10	2.85	....	1.17*o*	1.17*o*	1.17*o*	1.33*o*	1.33*o*	....	....	7.30*o*

‡Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* Sales tax included. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount 35c. 500 to 2000; 70c. 2000 to 5000; 95c. over 5000. *l* Up to 200 cu. yd. *m* 50c. off for cash. *n* 25 c.y. or more *o* 2% off for cash.

CASH DISCOUNTS, CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice, in Montreal 5% if payment before 15th.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$1.70	$1.65	Ironton, Ohio	$1.60	$1.55	Northampton, Pa.	$1.65	$1.60
Crestmore, Calif.	1.72	....	Iola, Kans.	1.70	1.65	North Birmingham, Ala.	1.75	1.70
Dallas, Tex. (Inc. 5c. tax)	1.80	1.75	La Salle, Ill.	1.70	1.65	Richard City, Tenn.	1.85	1.80
Hannibal, Mo.	1.70	1.65	Limedale, Ind.	1.70	1.65	Steelton, Minn.	1.80	1.75
Hudson, N. Y.	1.75	1.70	Mason City, Ia.	1.70	1.65	Universal, Pa.	1.65	1.60
Independence, Kans.	1.70	1.65	Norfolk, Va.	1.70	1.65	Waco, Tex. (Plus 5c. Tax in Texas)	1.75	1.70

LOWER PENINSULA, MICHIGAN. Uniform carload lot cement price established March, 1937.

PAVING BRICK, BLOCKS, ASPHALT, ROAD OILS—F.O.B. CITY

	PAVING BRICKS AND BLOCKS			PAVING ASPHALT (Per ton, less than 80 penetration,)		ASPHALT BINDERS—FLUXES (Per gal., 80–300 penetration,)		CUTBACK ASPHALT (Per ton,)		ROAD OILS (Per gal.,)	ASPHALT EMULSION (Per gal.,)	
	Granite per M, lots of 50,000, 4x4x8 in.	Brick per M, 3x4x8½ in., carload lots	Wood per sq. yd., 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$75.00	$39.35	$2.25	$18.20*e*	$23.41*e*	$0.0728*e*	$0.1049*e*	$.0768*he*	$.1089*he*	$0.0668*e*	$0.0834	$0.0834
Baltimore	140.00	44.00‡	2.75	15.00	20.00	.06	.085	.07*h*	.10*h*	.....	.....	.....
Birmingham	.....	25.00	.....	19.80	24.80	.0804	.1054	.082*h*	.112*h*	.....	....	.....
Boston	75.00	47.00	3.25	17.00‡	22.00‡	.07‡	.095‡	.09*h*‡	.12*h*‡	.075‡	.095‡	.125‡
Chicago	140.00	48.00	2.30	18.00	23.00	17.00*g*	22.00*g*	.07*h*	.11*h*	.05	.09	.135
Cincinnati	112.00	37.50	.....	13.47	17.47	.12	.....	17.00	.....	.051	.078	.....
Cleveland	110.00	37.50	2.85	17.50	21.75	.08	.095	.09*h*	.10*h*	.06	.095	.10
Dallas	.....	32.50	.....	15.80	20.00	.05	.08	14.80	23.00	.05	.075	.105
Denver	.....	27.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	35.00	.....	16.72*f*	21.97*f*	.....	20.60*g*	15.60	20.60	.0535	.1125	.1525
Kansas City	.....	44.00	.....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.15
Los Angeles	.....	50.00	.....	11.00	15.16	11.00*g*	15.16*g*	11.00	.....	.042	.06	.12
Minneapolis	.....	.....	1.90*d*	21.70	26.70	.098	.137	21.85	34.65	.0638	.....	.....
Montreal	85.00*c*	60.00	3.62	14.00	20.00	.10	.13	.0975*h*	.1175*h*	.0675	.135	.165
New Orleans	.....	.....	.....	14.00*a*	19.00*a*	.055	.085	.06*h*	.09*h*	.05	.078	....
New York	.....	67.00	2.85	15.10	20.50	.06	.085	.07*h*	.10*h*	.....	.075	.11
Philadelphia	120.00	.....	.....	15.00	20.00	.06	.085	.065*h*	.095*h*	.055	.07	.10
Pittsburgh	115.00	40.00	.....	19.00	24.00	.077	.1125	.068*h*	.121*h*	.0675	.....	.....
St. Louis	115/130	37.00	.....	19.20	24.20	.078	.108	.081*h*	.111*h*	.045	.09	.12
San Francisco	.....	70.00	.....	12.00	18.00	12.00*g*	18.00*g*	12.50	23.00	04	.0475	.117
Seattle	.....	60.00*i*	.....	25.55	25.55	19.50*g*	25.55*g*	15.50/16.50	28.50	8.15*g*	.075	.1325

‡Delivered. *a* F.o.b. Baton Rouge. *b* 4x5x9 in. aver. *c* Sales tax included. *d* 2½ in. 6 to 8-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* 3½x4x8½ in.

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IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¼-in. billet *b*	RIVETS ½-in. structural	WIRE NAILS Base	SHEET PILING Base	STEEL RAILS Per Gross Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle bars	Std. spikes *c*	Tie plates *c*	Track bolts
Birmingham	$2.40	$2.60	$3.70	$2.55	....	$42.50	$43.00	$42.00	$2.80	$3.15	$2.30	$4.35
Chicago	2.30	2.60	3.70	2.80	$2.70	42.50	43.00	42.00	2.80	3.15	2.30	4.35
Pittsburgh	2.25	2.55	3.60	2.75*d*	2.60	42.50	43.00	42.00	2.80	3.15	2.30	4.35
Buffalo	2.35	2.60	....	....	2.70	....	....	....	....	....	2.30	....
Cleveland	2.44‡	2.60	3.60	....	.	....	....	....	....	....	....	....
Youngstown	....	2.60	....	....	....	....	....	....	....	3.15	....	....
Gulf ports	2.65a	2.91a	. . .	....	3.05a	....	....	....	....	....	....	....
Pacific ports	2.80a	2.96a	....	....	3.05a	....	....	....	....	3.15	2.40	....

‡ Delivered. *a* F.o.b. cars dock. *b* For rail steel deduct 15c. from billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone, Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per o.l.

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb., base price	REINFORCING BARS Per 100 lb., ¾ in., base price 15 tons or over *b* New billet	Rail steel	Add $/cwt. for Switch	Del.	EXPANDED METAL LATH —Per 100 sq.yd., carload lots— Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING —Per 100 s.f., carload lots— 6x6 in., No. 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6 & 6 wires Per sq. yd.	SHEET PILING Per 100 lb base price
Atlanta	$3.65	$2.82	$2.67	.02½	.10	$21.00	$23.00	$1.75	$1.31	$0.1692	$2.60
Baltimore	3.90	2.95	2.80	....	.10	25.00	28.00	1.62	1.22	.1566	3.00
Birmingham	2.40*a*	2.60	2.45	.02½	.10	22.50	24.50	....	....	.....	....
Boston	4.07	3.08	2.93	$20 C.L.	.10	21.60‡	23.60‡	1.68	1.26	.1620	3.07
Chicago	2.30*a*	2.60	2.45	.03	.05	23.00	25.00	1.61	1.22	.1557	2.70
Cincinnati	3.95	2.815*c*	2.665*c*	....	.05	21.50	23.50	1.60	1.21	.1548	....
Cleveland	3.86	2.60	2.45	.02½	.10	21.50	23.50	1.59	1.20	.153	....
Dallas	2.45	3.335	3.185	....	....	.....	.....	1.86	1.38	.1791	2.85
Denver	4.48	4.00	3.85	....	....	23.50	25.50	1.87	1.38	.1809	....
Detroit	3.96‡	2.71	2.56	....	.10	22.50	24.50	1.62	1.22	.1566	2.875
Kansas City	4.24	3.02*c*	2.87*c*	.0	.05	20.50	22.50	1.82	1.29	.1655	3.13
Los Angeles	3.825	2.95	2.80	.02½	.05	23.00	27.50	1.89	1.40	.1827	3.72
Minneapolis	4.00‡	2.81*c*	2.66*c*	.0	.10	26.00	30.00	1.71	1.28	.1656	3.01*d*
Montreal	2.90	2.40	2.40	....	....	32.50	35.50	2.46	1.82	.253	3.50
New Orleans	....	3.04	2.89	.05	.10	21.00	23.75	1.76	1.31	.1701	3.05
New York	3.97	2.79	2.64	....	.05	21.50	23.00	1.67	1.26	.1584	2.93
Philadelphia	3.90	2.84	2.69	....	....	22.50	24.50	1.63	1.23	.1575	2.89
Pittsburgh	2.25*a*	2.55	2.40	.02½	.10	21.50	24.50	1.55	1.18	.1494	2.60
St. Louis	3.99	2.77/2.89	2.62/2.74	.0	.05	22.00/23.00	25.00/26.00	1.62	1.21	.1566	2.70
San Francisco	3.95	2.95	2.80	.02½	.10	25.50	27.50	1.89	1.39	.1827	3.50
Seattle	2.80*e*	2.95*e*	....	....	....	25.50	27.50	1.89	1.39	.1827	3.05

‡ Delivered. *a* Mill prices. *b* 5-15 tons, add 15c. 1-5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE Per foot, 8 in., s.s.	delivered, 12 in., s.s.	ASTM C13-35 24 in., d.s.	36 in., d.s.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered: ASTM C 14-35 12 in.	24 in.	WROUGHT STEEL PIPE Full standard weight. *h* 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap Weld Black %	Galv. %
Atlanta	$50.00	$0.26*bc*	$0.468*bc*	$1.69	$4.50*c*	$85.00	$128.00	$0.45	$1.625	44.5	35.5	42	32
Baltimore	53.50	.30	.52	2.40	6.25	110.00	170.00	.50	1.75	....	....	....	
Birmingham	46.00	.25	.45	1.625	4.66	85.00	220.00	.40	1.60	64.5	55.5	62	52.5
Boston	53.50	.217	.4185	1.755	5.33	136.00‡	196.50‡	.45	2.50	....	....	....	....
Chicago	54.50	.28	.54	2.25	6.25	100.00‡	150.00‡	.38	1.48	52.5	41.25	50.625	37.5
Cincinnati	53.00	.203	.3915	1.665	5.0225	75.00	120.00	.60	1.90	52.6875	41.4375	49.5625	37.6875
Cleveland	54.50	.154	.297	1.26	3.9975	69.00	108.00	.36	1.80	56	44.5	51.5	40.5
Dallas	58.00	.40	....	....	. . .	160.00	260.00	.46	1.57	69.5	61.5	67	58.5
Denver	66.00	.29†	.50†	2.10†	....	130.00	220.00	....	....	44	33	41	29
Detroit	52.60	.203	.3915	1.71	5.2375	76.50	130.00	.33	1.50	53.2	41.9	50.1	37.8
Kansas City	56.00	.30	.54	2.16	5.00	120.00	240.00	.45	1.60	48.8	37.5	45.6	33.8
Los Angeles	54.50	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	57.1	48.1	54.6	44.6
Minneapolis	57.00	.24†	.432†	1.728†	4.60†	.....	.....	.65	1.75	....	....	....	....
Montreal	60.00	.55*e*	.90*e*	3.15*e*	....	.....	.....	....	....	....	....	....	....
New Orleans	50.80	.26	.468	1.69	....	150.00	220.00	.37	2.10	....	....	....	....
New York	53.00	.27	.55	2.15	5.84	.....	.....	.50	1.50	52.49*i*	41.53*i*	48.20*i*	37.80*i*
Philadelphia	50.00	.224	.45	2.25	6.00	150.00	180.00	.54	1.80	64.5*i*	55.5*i*	62.*i*	52.5*i*
Pittsburgh	56.00	.168†	.324†	1.53†	4.4075†	97.80	154.20	.85*g*	2.00*g*	64.5*j*	55.5*j*	62*j*	52.5*j*
St. Louis	53.00	.28	.504	2.016	3.96	85.00	170.00	.75	1.80	51.125	39.875	48.6	36.125
San Francisco	55.00	.315*d*	.567*d*	2.268	5.67	103.50	172.50	.45	2.50	53	44	42.75	33.33
Seattle	55.50	.294	.441	2.142	5.355	68.00	160.00*f*	.60*f*	1.60*f*	37	27	37	24

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N. J. (base) $50.00. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* Sales and municipal taxes extra. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list for delivery from warehouse, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.: ¼ in., 8½c.; ⅜ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. *i* Resale price to consumer, car load lots shipped from mill. *j* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points less. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Buttweld — 1 in. and 1¼ in. black 30, galv. 14; 1½ in. black 34, galv. 16½; 2 in. black 33½, galv. 16. Lapweld — 2½ in. to 3½ in. black 27½, galv. 12½; 4½ in. to 8 in black, 28½ galv. 15.

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